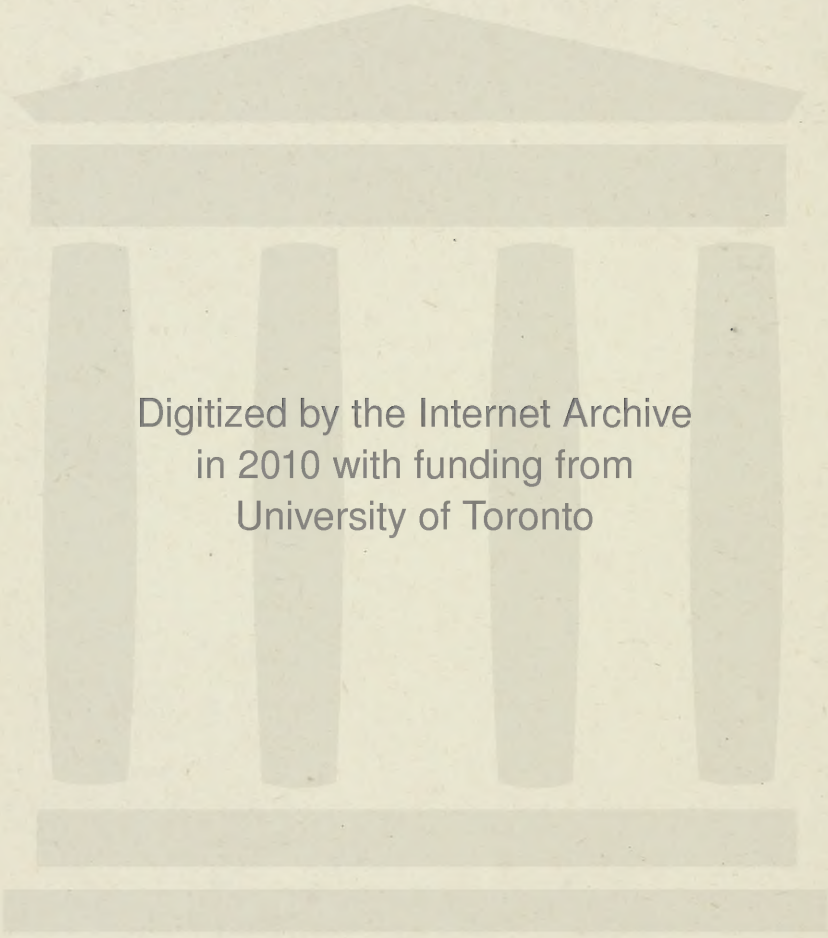

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MANCHESTER, 1902.

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FROM A PHOTOGRAPH TAKEN AT THE CONGRESS OF THE INSTITUTE HELD AT NEWCASTLE-ON-TYNE IN 1896.

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JOURNAL
OF
THE SANITARY INSTITUTE.

DISCUSSION ON

THE COLLECTION, DISPOSAL, AND UTILIZATION OF TOWN REFUSE IN LEICESTER.

Opened by F. W. ALLEN, Assoc.M.Inst.C.E.,
Assistant Borough Surveyor, Leicester.

At Provincial Sessional Meeting at Leicester, December 5th, 1903.

THE subject which I have the honour to bring before you to-day by the favour of the Borough Engineer, although it may not be a very attractive one, is still full of interest to the sanitarian. As the pathologist does not shrink from probing to their depths the nature and cause of disease, so it is necessary that we should treat with equal thoroughness one of the most important methods for its prevention.

Repulsive as it may appear in many of its details, it is, I venture to state, second in importance to none of the problems which face those who have the health of our large communities at heart.

Those of you who have been connected with the administration of the Public Health Acts for a period of thirty years or so and have observed the antecedents of disease, will agree that a population living amid conditions of faulty domestic sanitation cannot continue healthy.

It is a case of the survival of the fittest. The strong withstand the pernicious effects of impure air for a more or less extended period; but their general health is gradually undermined. The weakly and susceptible succumb with a readiness which is only too familiar in our more densely populated districts.

Atmospheric impurity, owing to the presence of decaying animal and vegetable matter or the emanations from cesspools, is a fruitful source of

disease and the removal of these sources of pollution is followed by a corresponding diminution of sickness.

For sanitary reasons, therefore, three courses of action are imperative.

(1) All excreta should be removed from dwellings immediately, and the removal should be carried out in the most economical method and with the least possible annoyance. Water carriage is no doubt the best and cheapest means of transport; but this method of disposal is a subject which does not come fairly within the scope of this paper.

(2) House refuse with all its animal and vegetable matter, and trade refuse, including offal from fish-shops and slaughter-houses, decaying fruit, market refuse, etc., should be dealt with systematically and with the minimum of handling.

The disposal of the conglomeration of more or less foul matters is no slight undertaking, and, when one looks back to the time when such materials were tipped into worked out clay and sand-pits, one wonders how the people, who subsequently lived in the houses built thereon, enjoyed anything like a reasonable freedom from sickness.

The proper system is, I submit, destruction by fire.

(3) Street cleansing should be executed in such a manner as to secure the most thorough removal of surface filth and decomposing matters, and should be regularly carried out under the best possible conditions as regards men, materials and plant.

To facilitate this process, impervious, well-laid and properly drained pavements and a good supply of water are of the first importance.

It may be interesting to trace the progress of Leicester in its endeavours to attain these ideals.

Leicester is on the line of the Roman Via Devana, and the older parts of the town are built on the site of a Roman camp.

Occasional finds of broken Samian, or other ware, deposited in wells (or cesspools perhaps), and in "made" ground, where clay or sand had been excavated, seem to point to the conclusion that the Romans adopted much the same method of refuse disposal as obtained in Leicester in 1851.

Our reputation for rapid progress would seem, therefore, to be of somewhat recent growth.

At this latter period, then, our town, with its population of 60,000 persons, a total area of 3,030½ acres, and a built area of (say) 600 acres exhibited all the worst conditions.

Being an old walled town, its streets were narrow and tortuous, and paved with cobbles and pebbles. Its houses were crowded, its yards confined in area and paved, where paved at all, with pebbles.

A total lack of proper sewerage; the abominable privy system in full swing with all its offensive appendages of deep, open, reeking cesspool or covered vault; open, deep manure pits; a water supply, obtained for the most part from shallow surface wells placed, as usual, in close proximity to the cesspools; no proper system of refuse removal, the farmers attending to the cesspools, vaults, etc., when it suited them best (their leaky waggons frequently leaving a filthy ill-smelling trail through the streets after the night's work); these were the environments of the Leicester man fifty years ago.

Thus it came about that during the hot months of July and August, when the diarrhœa scourge would be at its height, the town was in the most unhealthy condition.

There were also in the oldest and most densely populated parts of the town no fewer than 104 slaughterhouses (1 to every 600 persons), with large open cesspools or manure-pits, on which pigs were kept in some instances for the consumption of blood and offal; many of the slaughterhouses were without any drains whatever, the scourings of their yards being traceable over undrained and badly paved streets for a considerable distance before finding an exit by a more or less direct route through the old shallow box drains, which did duty as sewers, into the river.

At a moderate computation therefore there must have been an area of reeking filth equal to something like three acres.

There is no record of street cleansing in those days; but some years later the cleansing was let to working contractors, who usually worked a whole district with a small cart and a patient donkey.

Add to this the fact that July floods very often covered a considerable portion of the built area in the West end, leaving a filthy deposit of mud in street and dwellings, and I think everyone will agree that the death rate of 24·9 per 1000 (a percentage of 29·5 under one year of age) was under the circumstances not to be wondered at.

The first attempt to remedy this condition of things was made about the year 1849, after the passing of the Public Health Act of 1848, when Mr. Thos. Wicksteed, C.E., was called in to design a system of sewers and sewage disposal.

Sewers were laid, works were executed at a cost of some £40,000 between 1854–8, and water closets were introduced in large numbers.

Owing however to defective construction (in the light of modern practice) and the bad outfall, the sewers in some districts became silted up.

The borough engineer in his report of June, 1898, describes the condition of thirty miles or so of these sewers and the defects very graphically.

Owing to these difficulties of sewerage, the pail system was introduced about the year 1871, and many of the water closets and privies were converted into pail closets, the cesspools being filled up and used as ashpits.

Pails were provided by the Corporation at a cost of 10s. 6d. each to the property owner, the Corporation renewing the pails from time to time, as required, without further charge. They also undertook the collection and disposal of the contents.

This obtained until the year 1882, after which date no plans were approved shewing anything but water closets.

From this date also open dust-pits and manure-pits were gradually roofed in and ventilated and reduced in dimensions where of large area, and new ones were constructed of very small area, paved at yard level, and similarly roofed in and ventilated. Needless to say, the emptying of these confined dust-pits was anything but a healthy occupation, either when very wet (as they frequently were by reason of the throwing in of slops) or when very dry and dusty. Portable dust bins were also provided in isolated cases where the refuse had to be carried through dwelling houses.

In 1886 a sort of unofficial commencement was made in the introduction of a general portable bin system by persuading builders and architects depositing plans to adopt bins in all new property. In many cases the roofed dust-pits were altered and bins provided, the old dust-pit being used as a coal or store place, or sometimes as a bin shed.

The Floods Prevention Works, the New Main Trunk Sewers and the Sewage Farm were also making good progress, and better facilities for the installation of a complete water carriage system were coming into view.

The following particulars as to the borough in 1886 may be of interest:—

Total area	3,030	acres.
Built area	1,300	„
Population	131,976	
Miles of streets	74	
Houses	26,934	
Water closets	13,821	
Pail closets	6,500	

Privies	200
Ash-pits	11,500, from which 38,497 tons of refuse were removed.
Slaughter-houses ...	70
Cow-sheds	173
Wells	361, supplying a population of 3,800 persons.

Plant for Refuse Collection and Disposal—

5 canal boats.	26 railway wagons.
13 pail collecting vans.	2 nightsoil carts.
40 ash carts.	8 box wagons.

7,000 pails (working stock).

Employing 118 men and 46 horses.

A portion of the house refuse was carted away to tips (some now built on). The precautions taken in covering these tips with 10 ft. or so of earth, and the enforcement of a layer of concrete over the whole site of each house appears to have been effectual. Another portion was mixed with manure, and still another portion was screened through a grid having bars spaced $1\frac{1}{2}$ inches apart.

By screening—

9·7 % of garbage etc., was separated and used as manure.
6·45 % of hard stuff and tins, glass, etc.
83·85 % of fine ashes.

It was anticipated that farmers would cart away the last for top dressing; but the expectations were not realized, and the system was abandoned.

The system of collection was as follows:—Ten sets of three men paid at the rate of 5d. per load per man, the horse, two carts and one driver being provided by the corporation.

Three other sets were employed in trade refuse collection.

The practice then was to have a standing cart while the loaded one was being taken to the tip, a practice which, I need hardly say, was open to serious objections and caused numerous complaints.

Some years later the standing cart was horsed, so that a gang or set of ash-pit emptiers consisted of two fillers and two working wagoners, all paid at the rate of 5d. per load per man, the wagoners having an extra 2s. a week for stable duty.

There was a cessation of complaints and an increase in the quantity of stuff collected; but the cost per load was more.

At this time we found that a load of wet house refuse from ashpits contained about 1½ cube yards and weighed about 58 lbs. per cubic foot, while ordinary bin refuse weighed 55 lbs. per cubic foot. The quantity per house per annum amounted to 55 cubic feet and the weight to 28 cwt.

In pail collection 10 sets of 2 men were employed, and they were paid at the rate of 1s. per load of 24 pails per man. Each pail yielded a weight of 47 lbs. per week, or 22 cwt. per annum.

The total cost of nightsoil, pail, and house, refuse collection and disposal was ... ... £11,850 per annum.
(Equals 1/9·55 per head).

Receipts from sales of manure, etc. ... ... £3,500 do.
(Equals -/6·36 per head).

Net cost ... ... £8,350 do.

(Equals 1/3·19 per head, or £112 17s. per mile of street).

The prices obtained for manure were :—
For mixed manure, 2s. 6d. per ton on rail.
For pail contents, 23s. per wagon, delivered in fields per box wagon.

The private slaughterhouses, which had now been reduced to seventy within the borough, had still in many instances deep manure-pits which were very offensive. Constant pressure at length caused the butchers to form an association to undertake the frequent removal of refuse, and they have carried out the work more or less successfully ever since.

Street Cleansing.—There were at this period some seventy-four miles of streets, which were swept and cleansed from once to three times a week, and once a day in central thoroughfares. The work employed twenty-six men and twelve horses. The total cost was about £3,600 a year, or £48 12s. per mile per annum.

The great bulk of the carriageways at this period were either macadamized or random paved (without grouting), although a better state of things had been inaugurated some years before by the laying of granite sett grouted pavements in several public streets, and by the laying of uncreosoted deal pavements on the "Norwich" system in other public streets.

These wood pavements soon became nuisances. As the blocks were

not bedded hard on a concrete surface they wore into holes, and it became impossible to scavenge them satisfactorily.

The surface of the blocks, through the bruising of the fibre, acquired a sponge-like composition in wet weather, so that as a vehicle passed along, the absorbed water squirted out and sprinkled shop windows and foot passengers impartially.

The Borough was extended in 1891, so as to include an area of 8,586 acres and a population of 177,000.

Upon making a sanitary survey of the added areas a huge number of defects were found, and the primitive privy and pail pressed themselves into notice once more. Some cesspools had not been emptied for nine years, and in very many instances closets were without pails, buckets, tea-trays, biscuit tins, tubs, boxes, and all sorts of odd things doing duty.

There was no proper system of collection, and many tenants had to bury the excreta in their limited gardens.

In 1892 the construction of the main trunk sewers, designed by the late Mr. Joseph Gordon, M.Inst.C.E., the laying out of the sewage farm, and the installation of the powerful pumping-engines were practically completed by Mr. E. George Mawbey, M.Inst.C.E. The 8-ft. diameter main outfall storm culvert four miles in length, designed by Mr. Mawbey, was shortly afterwards completed.

The Corporation were now in a position to reorganise their system of house refuse disposal. The filling up of pits had long been a source of anxiety to the Committee.

The disposal of pail excreta (the supply of which was constant) was interfered with by continued rain, frost, and snow, by harvesting operations, and the prohibition of surrounding local authorities.

Complaints were received as to the pails, although the receptacles were fitted with spring lids and properly washed with water, supplied through a hose at high pressure, before being replaced.

Other complaints were:—Disturbance of the inhabitants near the depôts; inconvenience to inhabitants by having to sit up to late hours to admit collectors; nuisance from depôts and from wagons passing along railways.

The competition of patent manures also interfered with the sale, and the difficulties generally were increasing year by year.

The pail system at its best is an expensive make shift one, and the only possible excuse for its adoption had been the absence of a proper system of sewers and adequate sewage disposal works, which had since been remedied.

The pail system is repulsive (especially in hot weather), liable to spread disease, and a constant heavy charge upon the rates.

The first step was to provide Destructors and, in order to test the feeling of the people, a plant of six of Manlove, Alliott & Co.'s cells was erected from Mr. Mawbey's designs. It was placed in the midst of a large population, within a mile of the centre of the town, and close to a large Board School, the stack being not more than twelve feet from the school boundary. This Station was paid for out of revenue.

There are moreover—	Houses.	Population.
Within 100 yards radius ...	70 ...	350
„ 200 „ „ ...	340 ...	1,700
„ 300 „ „ ...	880 ...	4,400
„ 400 „ „ ...	1,880 ...	9,400

Encouraged by the success of the first, two more six-cell works were erected shortly afterwards, at about the same distance from the centre of the town, followed by a fourth quite recently three quarters of a mile further away.

In pursuance of instructions the Borough Engineer reported in 1896 that the cost of collecting and disposing of the 10,320 tons of excreta from 6,395 pails was £3,000 or 9s. 5d. per closet per annum (nearly) for working expenses.

That the capital charge per closet per annum for conversion into water-closets would not be more than	7s. 4¼d.
That the extra sewage resulting from the 6,395 water-closets would amount to about 61,000,000 gallons per annum, which could be pumped and treated at a cost of £550, equal to	1s. 9d. per closet.
	9s. 1¼d.
Deducting profit on water supply to water-closet (6s. a year) 10 per cent. on this	7d.
Total cost of w.c. during loan period ...	8s. 6¼d.;

Against 9s. 5d. by pail system.

The saving during the loan period would therefore be 11d. per closet and the ultimate saving, after the loan period, 7s. 3d. per closet.

A comparison of the pail system and water carriage works out as follows:—

Pail System.	Water Carriage.
Costs 1½d. in the £ on the rateable value of the whole Borough.	Costs ½d. in the £ on the whole Borough.
Cost per closet per year, collection and disposal ... ... 9s. 5d.	Cost per closet per year, pumping and treating ... ... 1s. 9d.
Cost per ton of excreta 6s. 0d.	Cost per ton of sewage, pumping and treating ... ⅜d. (·336)
Ditto, per 1,000 gallons 30s. 0d.	Ditto, per 1,000 gallons 1½d.
Owners do not pay for water, and absolute cost to ratepayers is as above.	Owners pay for water for w.c.'s, and profit on water say 7d. per closet per annum reduces the absolute working cost to 1s. 2d. per closet per annum, or one-third of 1d. in the £.
Against cost of 9s. 5d. per pail closet per annum.	Capital charge per closet per annum for conversion into w.c.'s 7s. 4¼d.
	Working expenses as above 1s. 2d.
	8s. 6¼d.

In the same year powers were granted to the Corporation under a provisional order to require owners to alter closets (other than w.c.'s) into water-closets, and also to require a separate moveable or other receptacle for ashes and house refuse. If such closets had been certified by the Medical Officer of Health as nuisances the alterations were to be carried out at the sole cost of the owners, although power was given to the Corporation to contribute towards the expenses.

Upon an owner failing to comply with a notice to convert, the Corporation were authorized to do the work and recover the cost.

Acting under the powers of the Order, 5,185 pails and 135 privies have at this date been converted into water-closets by the owners, at a cost to the Corporation of £13,012, equal to £2 9s. per closet.

The preliminary inspections and arrangements for contributions were made by the Medical Officer of Health and the Chief Inspector of Nuisances, and the whole of the drainage and structural work was examined from time to time by the Building Inspectors in the Borough Surveyor's Department.

So two of the chief items of town refuse are within measurable distance of satisfactory disposal.

We have now to consider the conditions of present-day Leicester, and the following figures may facilitate the process:—

Total area...	8,586 acres.
Built area...	about 2,200 acres.
Rateable value	£1,061,169
Population	220,000
Miles of streets	177
Houses	44,000
Water-closets	42,678
Pail-closets	593
Privies	68
Manure-pits	280
Ash-pits	2,049
Portable ash-bins...	46,216
Private slaughterhouses	76
Public slaughterhouses	18
Cow-sheds	63

Death-rate from Medical Officer's Report (1902) 14·65.

House Refuse Collection is carried on in 177 miles of streets by the direct labour of Corporation workmen for the most part, a small district being scavenged by a contractor.

The great bulk of the refuse is tipped at the destructor stations, and eighty-four per cent. of it is collected from portable bins.

The men work in gangs of six with two horses and carts to each gang so that five men are always loading.

The carts have deep side boards and hold about two cubic yards.

Refuse both from ash-pits and bins is much lighter than heretofore, that from ash-pits weighing 47 lbs. per cubic foot, and that from bins 45 lbs. per cubic foot.

Each bin yields 13½ cwt. per annum (nearly) and the contents are collected once a week at least.

Each ash-pit yields 68 cwt. per annum, and the pits are emptied at

intervals of about eight or nine weeks. Refuse per head 9·7 cubic ft. or 3·92 cwts. per annum. Refuse per house 47·3 cubic feet, or 19·2 cwts. per annum, a reduction all round of 31 per cent. on the record for 1886.

The quality of the refuse has altogether changed since the introduction of the bins. It is drier, lighter, and in summer especially is little more than fine dust, paper and vegetable matter, and the usual domestic rubbish.

The very large proportion of persons working in factories, the facilities afforded by the Gas Department for the hire of gas stoves and for the supply of gas by slot meter has something to do with this reduction.

Another factor is, that portable bins are not calculated to hold an unlimited amount of vegetable refuse and rubbish, some of which has therefore to be burnt by householders.

The few pails remaining are scattered all over the town and the collection now finds employment for four men and six horses only.

The plant for the refuse collection is as follows:—

Plant.	*Men.*
65 carts.	24 ashpit emptiers.
47 railway wagons.	70 bin collectors.
4 slop carts.	7 night men.
1 tip wagon.	8 wharf men.
4 pail vans.	4 foremen.
1 pail cart.	4 old men (sorting refuse).
7 box wagons.	
3 canal boats.	

Total 117 men ... 47 horses.

The collection of house refuse is as shewn hereunder:—

	Tons.		
From ashpits ...	7,002	costing 2s. 6d. per ton for labour and horses only	
Do. bins ...	33,141	do.	3s. to 3s. 6d. per ton.
Do. do. ... (Suburban).	2,997	do.	3s. 10d. per ton.
Trade Refuse...	1,562	do.	2. 6d. do.
Total ...	44,702 tons.		

	Loads.	
Manure	10,588	
Night soil	1,092	
Pail excreta	624	
	= 7,010	tons.
Grand total	51,712	tons.

The rubbish picked out of house refuse presents a curious medley, varying from a bath to a button or a perambulator to a penny whistle.

During the year ended the 7th November last, no less than 7,774 dozens of ginger beer bottles were sorted out and sold for £146 9s. 9d.

Certain men have a bonus of 50 per cent. of this amount and of other receipts for "sortings," which is distributed quarterly.

The dividends for the year averaged 8s. 2d. per man per quarter.

Bottle glass is sold at	10s.	per ton.
White do.	do.	20s. do.
Sauce bottles	do.	2d. per doz.
Medicine do.	do.	1½d. do.
Jars	do.	3d. do.
Wine bottles	do.	6d. do.
Pickle do.	do.	3d. do.
Champagne do.	do.	4d. do.
Claret do.	do.	5d. do.
Rags	do.	1s. 6d. per cwt.
Bones	do.	2s. 6d. do.
Light scrap iron	do.	15s. per ton.
Galvanized scrap	do.	7s. do. in trucks.
Detinned scrap	do.	3s. do. do.

The total cost of collection, less receipts, amount to £12,846, which equals 1s. 2d. per head of population, or £72 12s. 0d. per mile of streets, as against 1s. 3·19d. per head and £112 17s. 0d. per mile in 1886.

Disposal. The great bulk of house refuse is cremated at the destructors, as shown hereafter; but some portion of it, such as the bottoms of wet ash-pits goes away with the manure.

During the year the sales were as follows:—

	£	s.	d.
7,080 tons manure by railway wagon ...	885	0	0
520 „ „ „ canal boat ...	81	18	0
90 „ pail excreta per box wagon ...	31	10	0
54 „ „ „ „ carts	5	0	0
3,072 loads trade refuse removed ...	384	0	0
Total ...	£1387	8	0

PARTICULARS OF THE FOUR DESTRUCTOR STATIONS.

	No. 1.	No. 2.	No. 3.	No. 4.
Area Site	2,030 S. yards.	1,800 S. yards.	4,200 S. yards.	5,727 S. yards.
Cost of Site	£1,776	£1,356	£3,150	£3,006
Cost of Buildings, Cells, Engine and Plant complete	£6,561	£6,529	£7,238	£11,969
Cost of Stack	£1,167	£1,540	£1,615	£1,461
Total Cost	£9,504	£9,425	£12,003	£16,436
Description of Stack	Octagonal in each case.			
Height of Stack	160 feet. Fire-brick lined up to 40 ft. high.	180 feet, lined throughout.	180 feet, lined throughout.	180 feet, lined throughout.
Batter	One in 35·433.			
Size of Flue	4′ 10½″ over sides.	5′ 6″	5′ 6″	5′ 6″
No. of Boilers	3, with Feed-heater in main flue.	1	1	3, with Green's Economiser.
Description of Boilers	11′ 0″ × 7′ 0″ Multitubular.	11′ 0″ × 7′ 0″ Multitubular.	11′ 0″ × 7′ 0″ Multitubular.	Water tube with 4″ tubes and 735 s. ft. heating surface in each. Wood & Brodie's System.
Description of Draught	Forced by Fan.	Natural.	Natural.	Forced by Fan.
Water Supply	Water Works.	Water Works and Well.	Water Works and Well.	Water Works and Well.
Other Plant	Horizontal Engine, Clinker Crusher. Screen. Mortar Mill.	Same as No. 1, with addition of Steam Disinfector.	Same as No. 1.	Same as No. 1, with Auxiliary Engine for Fan. Slab-making Plant.
Utilization of Steam	Driving above. Heating a Board School, Driving a large Engineering Works until recently.	Driving above, and for Disinfecting Apparatus.	Driving above.	Driving the whole of the above as well as Pumping and Heating Water for adjoining Baths.
No. of Cells and Design	6, Manlove, Alliott & Co.	6, Boro' Engineer's Design.	6, Boro' Engineer's Design.	6, Manlove, Alliott & Co., Wood & Brodie's System.
Furnace Bars	Biddle's Patent Rocking-bars in each case.			
Charging Accommodation	Open tip.	Open tip.	Open Tip.	Boulnois & Brodie's Charging Apparatus.
Stokers' Wages	4s. 8d. per 8 hour shift; 1s. per week extra for leading man in each shift when steam-raising on night shift. Each man has a week's holiday in the year—wages paid.			
No. of Stokers employed	Varies from 4 to 6 at each works according to season.			

The record of the Refuse destroyed, Wages paid, and Materials prepared for Sale during the year ending 29th October, 1903, is as follows:—

Destructor.	Quantity of Refuse Destroyed.									Wages Paid.			Mortar			Materials prepared for Sale.		
	Ash-pit and Bin Refuse.			Trade Refuse.			Meat and Fish.									Fine Ashes.	Rough Clinker.	Crushed Clinker.
	T.	*c.*	*q.*	*T.*	*c.*	*q.*	*T.*	*c.*	*q.*	£ *s.* *d.*			*T.*	*c.*	*q.*	*Loads*	*Loads*	*Loads*
No. 1.—Nedham Street ...	10,585	5	3	194	2	3	20	0	1	656	7	4	266	0	3	553½	2,005½	523
No. 2.—Mill Lane	10,581	18	0	246	18	1	40	15	1	723	16	2	491	12	2	846¼	2,450¼	1,064
No. 3.—Lero	11,849	5	2	921	4	3	250	4	0	686	19	9	573	13	1	832¾	2,205	807½
No. 4.—West Humberstone	8,314	0	0	4	16	0	5	18	2	552	19	5	71	12	1	416½	1,515	395½
TOTALS FOR THE YEAR	41,330	9	1	1,367	1	3	316	18	0	2,620	2	8	1,402	18	3	2,649	8,175¾	2,790

The amounts received or chargeable for Steam or Prepared Materials, etc., during the same period are as shown hereunder:—

	Steam.			Mortar.			Fine Ashes			Rough Clinker.			Crushed Clinker.			Bones, Iron, etc			Burning Trade Refuse.			Total for Year.		
	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
Nedham Street.....	60	15	8	70	8	8	24	11	0	Free.			53	17	0	95	16	6	21	5	0	326	13	10
Mill Lane	...			123	18	5	34	19	0	5	6	0	84	16	6	95	4	8	27	5	6	371	10	1
Lero	...			155	16	4	41	12	9	Free.			64	2	0	79	7	6	92	11	8	433	10	3
West Humberstone.....	...			17	14	5	17	9	1	Free.			39	12	0	33	16	10	1	1	6	109	13	10
GRAND TOTALS	60	15	8	367	17	10	118	11	10	5	6	0	242	7	6	304	5	6	142	3	8	1,241	8	0

The average amount burnt per cell per day is about 6½ tons, and the cost of stokers' wages 8¾d. per ton.

The sales and charges, it will be noticed, recoup nearly 50 per cent. of the wages paid.

The total working expenses for the last financial year amounted to—

	s.	d.	
	1	4·63	per ton destroyed.
and the capital charges to—	1	1·25	„ „
	2	5·88	per ton destroyed.

The residuals amount to 33⅓ per cent. of the weight of the refuse destroyed.

The calorific value of house refuse is becoming less year by year in Leicester from the causes already referred to.

A test of the power developed by the steam raising plant at Nedham Street with ordinary multitubular boilers gave the following result:—

Evaporation Test, Nedham Street Destructor, Forced Draught.

Length of trial, 9 a.m. to 6 p.m. (9 hours).

	1901.			
	January 31st	February 1st	February 3rd	February 4th
Amount of refuse burnt, in lbs.	47,656	50,232	52,808	48,300
Amount of water evaporated, in lbs.	23,200	22,800	43,500	44,300
Average boiler pressure, in lbs. per sq. inch	54·5	56·6	56	53·6
Temperature of feed water	102° F.	117° F.	102° F.	104·2° F.
Amount of water evaporated per lb. of refuse burnt	·48	·45	·82	·91
Do. do. do. from and at 212°	·55	·5	·93	1·03

The slab-making plant is by Musker, of Bootle, and it cost, with building complete, £1,800.

It has not been in operation long enough to enable a trustworthy opinion to be given as to the cost of working; but after making due allowances for repairs, etc., it appears as though 2½ in. slabs could be made and sold for something like 2s. 8d. to 3s. per square yard.

Street Cleansing should be done by strong able bodied men. The work is hard and trying to the constitution, the men having to be out in the worst weather.

The idea that decrepit old men are good enough for street sweeping is a thing of the past. Employment should be found for those who have grown old in the service of the municipality by all means, but certainly not in this direction.

Our street sweepers are for the most part men in the prime of life, and the majority are paid at the rate of 6d. an hour.

The town is divided into three main districts, viz. :—

	Miles.	Yards.	
The Central, containing	124	...	of roads and street.
The Northern (Suburban)	17	1,496	do.
The Southern do.	29	1,466	do.
Total mileage scavenged	171	1,202	

At the main depot in Jarvis Street there are the usual stables, horse boxes, cart sheds, and carpenters', wheelwrights', blacksmiths', and painters' shops, where all repairs are executed. A certain number of new vehicles, moreover, are built for the Street Cleansing, as well as for the Refuse Disposal Department.

The sweepers are divided into—

Five main road gangs of five sweepers and two horses and drivers to each gang.

Eight district gangs of three sweepers and one horse and driver to each gang.

A main road gang cleanse 4,500 lineal yards per day at a cost of 16s. 7d. per mile.

A district gang cleanse 4,600 lineal yards per day at a cost of 9s. 1d. per mile.

A water-cart is capable of spreading 7,480 gallons per day at a cost of 1s. 4d. per 1,000 gallons. A four-wheel water-van is capable of spreading 9,450 gallons per day at a cost of 1s. per 1,000 gallons.

Horse-machine brushes, costing 24s. 6d. a set, last on the average four weeks; ordinary hand-brushes nine to twelve days.

The following Table showing the details of Road and Street Cleansing may be of interest:—

Cleansing and Gravelling Roads and Streets and Cleaning out Gullies and Side Drains.

	Roads, &c., cleansed—Times per week.								Total.	No. of Gullies.	No. of Orderly Bins.	Tons Sweeping Removed.	Tons Horse Droppings from Bins.	Tons Gravel used.	No. of Sweepers engaged.	No. of Orderly Boys and Men.	No. of Horses.	Cost per Year Wages and Horse Hire.	Cost per Mile per Annum.	Cost per sq. yard per Annum.
	6	4	3	2	1	Once 10 days	Once 14 days	When required.												
	miles	miles	miles	miles	miles	miles	miles	miles	miles									£	£	*d.*
**Central District* (Sanitary Committee)	10	2	14	5	93	...	...	...	124	6,900	33	31,200	1,250	470	50	13	20	7,496	60·9	1·12
Northern District (Suburban) Highway and Sewerage Committee.	...	...	...	3½	3	3½	8	...	18	968	...	2,500	...	30	7	...	2	702	39·34	·73
Southern District (Suburban) Highway and Sewerage Committee.	...	...	...	6	18¾	...	1	4	29¾	1,454	...	3,750	...	50	10	...	3	1,067	35·7	·66
	10	2	14	14½	114¾	3½	9	4	171¾	9,322	33	37,450	1,250	550	67	13	25	9,265	53·9 (average)	1d. per sq. yd. (average)

* The Cost of Street Watering varies from £500 to £700 a year according to the Season. * Sales of Sweepings, &c., realise about £200 a year.

PLANT FOR STREET CLEANSING, &c.

Central.	Northern.	Southern.
19 Ordinary carts.	2 Slop carts.	5 Slop carts.
23 Slop carts.	2 Horse sweeping machines.	2 Horse sweeping machines.
23 Water carts & vans.	2 Horse scrapers.	2 Horse scrapers.
16 Horse sweeping machines.		
7 Snow ploughs.		
5 Horse scrapers.		
7 Hand trucks.		

MEN EMPLOYED IN STREET CLEANSING, &c.

Central.	Northern.	Southern.
22 Carters and horse-feeders.	7 Sweepers.	10 Sweepers.
71 Street sweepers, Court and Urinal cleaners, Orderly men and boys, and Yardmen.	2 Carters.	3 Carters.
2 Wheelwrights.		
1 Blacksmith.		
1 Railway wagon repairer.		
1 Painter.		
1 Carpenter.		
4 Shop laborers.		

Thoroughly satisfactory results cannot be obtained by hand or machine brushing only, owing to the smearing by the brushes and the subsequent evaporation of surface filth, and there can be no two opinions as to the sanitary advantages of cleansing by water.

In narrow paved streets especially, the inhabitants would not only be freed from the wretched "fuggy" smell arising from the pavements in hot weather; but the air and the pavement also would be cooled by the process.

This, medical officers of health will agree, would be of great benefit in crowded close districts subject to visitations of summer diarrhœa.

From a cleansing superintendent's point of view it is also, no doubt, the best system for granite, wood, and asphalt pavements. Not that there would be any saving in plant, because washing by water cannot be carried on in frosty weather, and is not advisable in periods of heavy rain. There may be a saving in men, horses, and wear and tear of plant in sweeping and picking up, the effects of washing being perceptible in the reduced yield of sweepings in subsequent cleansings.

Washing should be carried out with water supplied through a hose at high pressure, the pavements being swept before flushing, the sweepings picked up in as dry a state as possible, and the gullies emptied before and after flushing.

The Borough Engineer has, however, to look at the question from a broader point of view.

(1) *As to its effect upon street pavements.*—Asphalt, wood and granite pavements, properly grouted, would not suffer; but granite setts or randoms, racked up with gravel in the old-fashioned way, would certainly be affected injuriously by the removal of the racking up and consequent loosening of the pavement.

Hardwood pavements are the better for flushing, and their life would certainly be prolonged if the process were regularly applied.

(2) *As to Water Supply.*—In Leicester, for instance, there are, say, 95 miles of paved streets that might be cleansed by water applied at low pressure by water carts and vans. If the average frequency of thorough cleansing be taken at twice a week only, this would mean 85 million gallons of water a year, equal to an increase of 11,000 in the population.

With a separate system of mains for manufacturers and trade supplies, this objection would be of no moment; but in

the case of a town like Leicester, where water is about to be brought from the Derwent Valley, and many miles of paved streets are constructed annually, it is a question whether such a lavish use of water would be judicious.

(3) *Sewerage and Sewage Disposal.*—With proper gullies and an efficient system of sewer flushing one would not expect that the sewers would be affected detrimentally; but where the combined system of sewers is in use and sewage has to be pumped and treated, the increase in the quantity to be dealt with would be a consideration.

The construction of a combined machine sweeper and loader has exercised the inventive powers of local men; but, after many trials, it has not been found quite satisfactory. It swept and picked up dust and sludge, but the intermediate sticky compound was beyond its powers, and the strain on the machine caused frequent breakdowns. It has however elements of usefulness; as, for instance, in sweeping wood pavements before washing.

A word on machine sweeping. On granite pavements it may be employed at all times; but its use on macadamised roads in very dry or very wet weather has a disastrous effect upon the surface by the removal of the key or binding. This brings under notice the application of a compound for keeping down dust and for the binding of macadam roads. Tar-washing proves to be an expensive and not a very lasting method of dealing with the question.

Tar macadam is also an expensive formation, difficult to repair satisfactorily, and liable to rapid disintegration, if the materials are not of the very best and laid in good weather.

Westrumite appears to have some good properties in dust prevention and promises to be a useful adjunct in the making of macadamized roads. The Highway and Sewerage Committee of this Corporation are about to experiment upon a short length of road with this compound.

Snow removal has not been a large item of expenditure for some years, but when a fall does occur, the Highway men and horses join those of the Sanitary Committee in clearing the streets.

I fear that our method of disposing of street sweepings is rather a crude one, but owing to the absence of tips, snow, sludge, and, in the autumn, leaves from the 5,000 street trees, have to be deposited on waste or unused building land. Dry sweepings, some of the sludge, and horse droppings are taken to depôts and sold, when possible.

Generally.—Any lover of animals will regret the disappearance of the

horse from the public streets, but the introduction of electric traction and motor vehicles will greatly reduce the pollution of thoroughfares due to horse traction. There would also be less disintegration of pavements and macadam, and therefore much less sweepings and droppings to remove.

In the case of Leicester the electric tramway installation alone will have the effect of reducing the accumulation of manure to the extent of 2,000 tons per annum.

In 1897 certain powers were given to the Corporation by Act of Parliament to abolish private slaughter-houses upon paying compensation to owners, lessees and occupiers. The clearing out of these undesirable establishments will rid the town of a very large amount of foul matter, equivalent approximately to 900 tons per year.

If motor vehicles were adopted for highway work, refuse collection, street cleansing, etc., it would result in a further reduction of 500 tons per annum.

I may say that the Sanitary Committee have not lost sight of the question of motor vehicles, but with the short leads to the destructors, averaging only about three-quarters of a mile, perhaps, and taking into account the inevitable wear and tear occasioned by the frequent stopping and starting necessary in refuse collection and the picking up of sweepings, etc., they came to the conclusion, after due inquiry, that it would not be advisable to abolish the horsed vehicles at present.

The Mayor of Leicester (Ald. A. E. Sawday) said that it gave him very great pleasure to welcome to Leicester the members of the Council of The Sanitary Institute and the other visitors present, and he extended this welcome with all the greater pleasure because he happened to be a member of a sister profession to theirs. In all matters which had to do with the well-being of the community, engineers and architects had a common interest, working side by side and hand in hand, and he hoped that in their several spheres they would do the best they could to raise the condition of the habitations of the people of this country. Leicester might be regarded, and had been so in late years, at all events, by sanitary engineers as a sort of happy hunting ground. Owing to various causes, they had been compelled in recent years to carry out very extensive works of a sanitary character, and in the conception, designing, and execution of those works they had been greatly assisted by the eminent engineers they had had in the persons of the late Mr. Gordon and in the present Borough Engineer and Surveyor, Mr. Mawbey, and by the very capable body of

assistants under their direction. He was glad that it was one of the oldest and most esteemed members of their engineering staff, Mr. Allen, who was to read a paper to them that morning on what in some towns was the very difficult and unsavoury question of the Collection, Disposal, and Utilization of Town Refuse. He ought also to refer to the great water scheme they had had in hand for many years, in which their Borough Waterworks Engineer, Mr. Griffith, had played a prominent part. The sanitary problems which had to be faced in this town had been very difficult ones with which to deal, for the site of Leicester was in a most unfavourable situation. Its position was very low, it rested on a stiff clay soil, the prevention of floods had presented great difficulties, and the provision of a satisfactory storm-water outfall had engaged serious attention for many years. Still, on the whole, they had solved these problems in what must be considered a fairly satisfactory manner. They had a large sewage farm and sewage disposal works which were answering their purpose very satisfactorily, whilst they had successfully solved the question of providing a storm-water outfall, and floods were a thing almost, indeed, he might say entirely, of the past. By its enterprise and willingness to carry out these necessary works at an enormous cost, Leicester had, he thought, set a very good example to other centres of industry. However, they probably knew a great deal more than he did about the work with which they had to deal, and his hope was that the result of their meeting would be very satisfactory from their own point of view and also from that of the public; for it was certain, that the greater the skill with which they brought about the reforms they desired to effect the better it would be for the people. He hoped, too, that their visit to Leicester would be a pleasurable one. The new parts of this town would, he felt sure, compare favourably with those of other large towns, and in the old portions of the borough they had archæological and architectural remains of an interesting description which were well worthy of their inspection. On behalf of the Town Council of Leicester, he begged to extend to them a very cordial welcome.

MR. E. GEORGE MAWBEY (Leicester) said he should like, in the first place, to propose a very hearty vote of thanks to his good friend the Assistant Borough Surveyor of Leicester for his very admirable paper. With regard to the sanitary work which had already been achieved in Leicester, it was a fact that during the last half century the death-rate had been reduced by as much as 10 per 1,000 per annum, and upon the present population of 220,000 that meant a saving of no fewer than 2,200 human lives a year. And it meant a great deal more; it meant the improved health and robustness of the people and a corresponding increase in their value as workers. He might also go so far as to say that the prosperity of that great town was due, to a large extent, to the increased good health and energy which had been brought about by the sanitary reforms that had been effected. Speaking of street sanitation, he submitted that the best conditions were secured by the adoption of impervious paving and the most per-

fect system of street watering, and by the most thorough sweeping and cleansing by water, that a town could afford. Whatever money was spent in those directions was well spent. On coming to Leicester, he found, as was the case in many other towns, large areas of badly paved streets, in the midst, unfortunately, as was usually the case, of thick populations, and there could be no doubt that deposits of impurities from the street surfaces, washed down into the imperfect joints and pervious bedding of these pavements, had been one of the causes of heavy epidemics of diarrhœa and other troubles. Conditions of that sort must be most conducive to the cultivation of anaërobic, if not pathogenic, germs of disease in those areas. It was noticeable that during the wet seasons, when the streets had been thoroughly washed by the downpours, the death-rate had been much lower. A good deal had been done in Leicester during the last twenty years or so in the right direction by the laying of about twenty miles of granite sett paving, grouted up with pitch and tar. They had also put down a considerable quantity of hard wood paving, instead of the soft, spongy wood of years gone by. The paving was mostly laid upon a bed of cement concrete, and that circumstance also was conducive to the improved health of the people. With respect to the principal subject dealt with in Mr. Allen's paper, they collected about 52,000 tons of house refuse a year, and of this quantity they burnt about 43,000 tons in the four destructors which had been erected. In order to avoid the carting of refuse through the streets from one portion of the borough to another, they adopted the plan of dividing the town into four districts, which had led to a great saving in cartage; on a great portion of the 43,000 tons of refuse burnt they effected a saving of at least one shilling a ton for carting, as they could readily realise when he informed them that the borough was five miles long and three miles wide. The question of providing a destructor cropped up as soon as he came to Leicester. In fact, the Chairman of the Sanitary Committee had already decided upon a site quite close to one of the Board Schools and an artisan population, and, moreover, he was determined that the cost of the land and destructor should be defrayed out of revenue in that instance. After the destructor had been at work for only one year, he said it was about time they had some more. So satisfactory had the results of the first one been that when they applied for a loan for the erection of two others, not a soul offered any opposition at the inquiry. They had now another destructor, and to the erection of that there was also no opposition. It was clear, from the experience they had gained there, that it was possible to build destructors in large centres of population without causing any nuisance, provided they were properly built and well managed. They did their best to utilise the waste heat from the destructors, but they must not expect too much in that direction. It was a mistake to do that, as anticipations might be falsified, for it was often found that, when obtained, a destructor did not produce as much steam as was expected from it. They were becoming particularly unfortunate in that respect in Leicester, for gas was in very general use for cooking purposes and for power in factories,

and consequently they did not get a very large proportion of such refuse as would produce the most heat. They had reduced their carting to an average of about three quarters of a mile, a factor which rendered the use of motor traction less necessary than was the case in some towns. With reference to the disposal of sewage, they had expended enormous sums of money in Leicester. Last year they pumped to the sewage farm—a distance of a mile and a half from the pumping station, and to a height of 170 feet, 2,756 million gallons of sewage, or about 12½ million tons, in the year. That meant that if the sewage had been allowed to accumulate in Leicester, it would have covered the inhabited area to the depth of five feet in one year. Just a few words about the manner in which they are dealing with the sewage. They had a sewage farm of 1,700 acres (1,400 acres available for sewage), but since they acquired that the borough has been extended, the population had increased by 50,000, and a great number of pail closets had been converted into water closets; consequently the requirements of the town had outgrown the capacity of the farm. The question arose, therefore, as to whether they should increase the area of the farm or adopt some other method of sewage treatment. What they did was to decide to increase the area of settling tanks and to provide twelve acres of bacteria beds. The sewage is pumped into detritus tanks, where there is some septic action, they did not want too much at that stage, then it would go into the twelve acres of bacteria beds, after which it would pass over the land for final purification. From experiments extending over fourteen months, they had found that that was the best system for Leicester, and that in practice on a large scale no better effluent could be produced than by this method. The effluent was equal to that obtained by the use of the detritus tanks and three contact beds, and was superior to that given by detritus tanks and two contact beds. The Local Government Board had passed the scheme, which he had prepared, embodying that system and involving an expenditure of £86,000, and also about £80,000 for additional new sewerage and pumping plant.

MR. ALDERMAN WINDLEY, J. P. (Leicester) said the theory of evolution had been demonstrated in Leicester in every department of sanitary work. During the last thirty years the Sanitary Committee had passed through almost every kind of experience and had tried nearly every kind of experiment in dealing with the refuse of the town. At the commencement of that period sanitary matters were in about as bad a condition as they could be. The sewers had been laid for about twenty years, and the cartoon they saw on the wall very fairly represented the state of many miles of sewers in that town. The brilliant idea which seemed to have occurred to the constructor of the sewers was that by omitting cement and mortar from the joints he could drain the soil above, neglecting to recognise the fact that what would let the water in would also let the sewage out. The consequence was that in storm times the sewage was forced into the sub-soil, and

they had suffered enormously from the foul sub-soil produced. Since that time they had introduced a main sewerage system, consisting of sewers some 8 feet in diameter, and laid in the most efficient manner, as illustrated by the cartoon exhibited. The ash-pit arrangements had gone through a similar process of evolution. It was at first suggested that the ash-pits should be drained, and orders were issued, but soon had to be stopped, as it was found that the drains rapidly filled up. Then it was decided that the ash-pits should be filled up to the ground level, but the water oozed out and this plan had also to be discontinued. Ash-pits of smaller dimensions were next ordered, but they also had been done away with in their turn. Those old abominations, privies and large cesspools, used to exist, mainly in the courts and alleys, and in many cases they were only a few feet from the doors of the cottages. The pail system having been brought to their notice by Dr. Clarke, a member of the Sanitary Committee, the Borough Surveyor, Mr. Stephens, reported upon the subject, with the result that they abolished privies and cesspools and introduced pails. This measure involved an enormous amount of work, and a very expensive plant for collection, sale, and transit by rail, etc. Eventually it was decided to abolish the pails and to substitute the water-closet system. The pails were an enormous improvement on the state of things previously existing, and the water supply was then so used up that it would have been very difficult to have brought water-closets into general use. Moreover, many people were careless in using water-closets, and where they were put in they had frequent applications from landlords to abolish them, and they were replaced by pails. Brushes, clothes, pieces of rag, and nearly everything you could mention were thrown into the pans, which were continually getting out of order. Since then they had obtained a better water supply and had been able to abolish the pails, or nearly the whole of them. He did not quite agree with Mr. Allen's conclusions as to the pails, for his opinion was that the earth system, if it could be adopted, would be the best, but in large towns that was impossible. Mr. Allen said that pails were not only expensive, but there was also a liability of contracting disease from their use. The same remark, however, applied to the water-closet system: it should not be imagined that when they pulled the chain they had got rid of the difficulty, for it was then that the risk of sickness began. In large towns where there was only a slight fall, the sewers became little better than elongated cesspools giving off sewer gas. Then they had to go to thousands of pounds of expense in pumping the sewage and getting rid of it. Mr. Mawbey, their Borough Engineer, had referred to the introduction of destructors, and to the action he took with regard to that question. They used to tip the ash refuse into old clay pits, but these got filled up, and the ever present difficulty was how to get rid of the ashes. No other method could be discovered that was comparable to the erection of a destructor, and it then became a question of cartage. He was anxious to find out whether a destructor had been erected near to dwelling houses, in any town, without becoming a nuisance, or danger, to health. With

that view, a deputation, of which he was a member, visited a large number of towns, and in London they saw a destructor which was entirely surrounded by buildings. It was on the strength of those investigations that he ventured to stake the reputation of the Sanitary Committee and the Town Council by the erection of a destructor near a Board School, and within a few yards of a number of respectable artisans' dwellings. While the plans were being got out, the owner of the houses begged them to desist, as, in his (the owner's) opinion, the erection of a destructor near his property would seriously depreciate its value, if not make it worthless. They endeavoured to re-assure him, and went on with the work. His fears proved entirely groundless, for the houses had never been empty from that day to this. He made these observations because he had had many questions put to him as to whether destructors could be erected close to dwellings without causing a nuisance. The early collection of house refuse was another improvement, but in his opinion there should be a daily collection if they were to have ideal sanitary conditions. As an improvement on the present weekly collection they might introduce a bi-weekly system, but in order to reach perfection the collection must be made daily. In addition, every street should be well paved, all cleansing operations should be carried out thoroughly, and he agreed with Mr. Mawbey as to the necessity of impervious paving.

Councillor A. Shaw (Leicester) said he was very pleased with the paper read by Mr. Allen, because it indicated that their attempts in the future would still be in a forward direction. It was a fact that the old pail system still had its friends and advocates. Indeed, he began to think their friend Mr. Alderman Windley was going to strongly advocate it that morning, but he did not really believe in it, they knew, but in the water-carriage system, and he had fought hard for the abolition of the 7,000 or 8,000 dirty pail closets which had been abolished in recent years. As to street watering, his conviction was that they would have to go further in that direction and also with regard to the cleansing of the streets. In former days they used to say—"Here is an old chap who has nowt to do, and if he had he couldn't do it," so they gave him a job as a road sweeper. Now they have men engaged in street cleansing who were full of strength and energy and possessed some intelligence as well. They wanted and would have men who knew the nature and importance of the work they had to do, and would accomplish it in an efficient and intelligent manner. He was glad that allusion had been made to the construction of the roads in the town, and he hoped the day would speedily arrive when macadamised roads would be absolutely things of the past. No matter how much they swept macadamised roads in wet weather, they would make sludge; no matter how they watered them in dry weather, they would make dust. It was with pleasure, therefore, that he heard it stated that experiments were to be made in Leicester with the object of obtaining roads of an improved character.

Dr. C. Killick Millard (Leicester) said he had listened to the excellent paper of Mr. Allen with very great interest. They must all agree that the various works included in the comprehensive title of that paper were of great benefit and utility to the community, but the question of their relative importance and value formed a point of some interest for their consideration. There were two distinct aspects of that subject of the collection and disposal of town refuse; first, from the point of view of the public convenience and the avoidance of public nuisance; second, from the purely sanitary standpoint. (1) Public convenience and the avoidance of nuisance was the aspect which was usually first forced upon the attention of public authorities, and from that point of view it was comparatively easy to decide the question of relative importance and to fix a standard of approximate perfection, as they had their eyes, ears, and noses, especially the last, to guide them, and if their own organs should fail them, those of other people quickly supplied the deficiency. To deal with that aspect of the question, it would be sufficient that ash-pits and dust bins were emptied before they got over-full; that the contents were removed and disposed of without causing nuisances in the way of unsightly accumulations and unpleasant smells; that drains and sewers did not smell or get choked up; and that roads did not get unduly muddy in winter or too dusty in summer. If there were any deficiences in any of these respects, they found that letters of complaint quickly revealed them. (2) But when they turned to the second point of view, the purely sanitary aspect, the problem was much more complex and they were beset by uncertainties. They all believed, he supposed, in the abstract, that the various measures comprehended under the term sanitation, including all those dealt with in Mr. Allen's paper, had a most important bearing on the health of a town. There in Leicester they certainly had good reason to believe it and to be satisfied with the results of the efforts which had been made during the last thirty years or so to improve the sanitation of the town. The general death-rate of the town had fallen most remarkably. During the five years ending December, 1872, the average yearly mortality was 26·8 per 1000 of the population, whilst thirty years later, during the five years ending 1902, it was only 16·7, a reduction of over 30 per cent., which was highly satisfactory, although some of that reduction must, no doubt, be attributed to altered age-incidence of the population and other causes. In 1901 the death-rate was 15·7; last year it was only 14·6; and in the present year he hoped it would be lower still.* The zymotic rate had decreased in an equally striking manner. There was very little typhoid fever, the deaths from that cause in the last four years having been only 28, 26, 20, and 12. As regards scarlet fever, there were only 11 deaths last year, and only 7 the year before, and that with a population of considerably over 200,000. With respect to small-pox, the number of deaths from this disease during the past thirty years had been so trifling as to cause the wonder of the whole

* The death-rate for 1903 was only 13·9—the lowest on record.

country. But when they came to ask the question: "What was the relative value of all the various sanitary works that had been carried out?" they found it very difficult to supply the answer. That was unfortunate, because it left them very much in the dark as to what their future actions should be. They wanted to make the sanitation of Leicester still better, and to further reduce the death-rate, but in what direction would the money be best spent? Should they spend more money on the improvement of their sewers? Should they collect the house refuse more frequently? Should they sweep their streets oftener and should they water them more frequently in summer? Their Borough Engineer had suggested, and he was inclined to agree with him, that one point which called for attention was improvement of the paving of their streets. The ordinary macadamised paving was unsuitable. Should they, therefore, have granite setts, which could be thoroughly cleansed by mere sweeping? To employ water for cleansing purposes was a better idea, but its adoption must prove rather expensive. To go in for a really improved system of paving would also be very expensive, but he believed the money would be well spent. Should they leave alone all the improvements already indicated and spend the money in making open spaces in the more crowded districts of the borough, where the old house property at present exists? The direction in which they should spend their money in future was a question upon which they required some light, or it was possible that the expenditure might not be productive of the very best results that could be attained.

Dr. T. Johnston (Rugby) said he thought he could say on behalf of the Sanitary Committee of the Rugby District Council that that opportunity of listening to such an instructive paper on the question of the disposal of house refuse had been a god-send to them. Rugby had been a sleepy old town, but it had just begun to wake up, and during the last two or three years the population had made a jump forward. They had been placed in a very great difficulty in relation to the subject of dealing with town refuse. The point which had been under much discussion recently, was whether they should have a refuse destructor or continue the old system of tips. They had a tip about a mile and a half from the town and in order to reach it had to traverse one of the worst roads imaginable. One reason why the road was so muddy was probably that some of the refuse got on to it, and they were constantly receiving complaints. He was pleased to say that the Sanitary Committee had decided to go in for a destructor, and it was with great interest that they had come here to learn the result of the process adopted in Leicester. The information they had received to-day was not only admirable, it was convincing, and he hoped that when they had seen the destructors they would be able to tell the Rugby Council that it had adopted the best means of getting rid of the refuse, and that it caused no unhealthy conditions in the surrounding localities.

Mr. H. J. Killford (Borough Surveyor, Ilkeston) said they hoped to erect a refuse destructor at Ilkeston within a very short time. Their town was a long straggling one, and he was glad to hear from Mr. Mawbey the value of splitting a town into districts, each with a destructor, so as to effect a saving in cartage.

Mr. H. A. Roechling (Leicester), after having complimented the author on the excellence of his paper, observed that the question of refuse destruction was a very important and at the same time a very interesting one. They had now a large number of empirical data obtained from careful observations and experiments, such as the quantity of refuse destroyed per cell in twenty-four hours, the evaporative power of refuse, &c.; but of the processes taking place during the destruction of the waste organic matters they knew but very little. It was very important, however, to have full light shed upon them, so that all the questions of a sanitary and economical nature that cropped up in each particular case could be fully and satisfactorily dealt with. He was glad to say very careful observations were now made abroad with a view to elucidating some of these obscure points. These experiments were being conducted with great skill, and he hoped they would lead before long to some definite results, which he might then be able to communicate to them. It was the duty of every one interested in matters of this kind to do his best to bring about further improvements both from a sanitary and economical point of view.

Mr. C. H. W. Biggs (London) said he should like to speak in support of Mr. Mawbey's observations, and to emphasise them. They had an object lesson in Leicester, where they were told something like ten lives per thousand per annum have been saved by the sanitary work which the Corporation have done in a certain number of years, whilst they also had it asserted as a fact that the general health of the community was better than it was before these reforms were effected. Now each human life had a money value, and each man in good health had a better money value than the man who was in poor health. It had been stated that sanitary work in Leicester had produced a certain return in reducing the death-rate and improving the health of the people, so the sole question was as to whether the return to be secured was equivalent to the amount of money expended. He thought it was. If the value of a life was taken at 20s. and they saved a life at the expense of 15s., they were 5s. in pocket. He maintained that they did not spend enough money in their large towns on sanitary work. He had given them a simple sum in arithmetic. It was worth thinking about and seeing if they could induce their councils to take more interest in sanitary work. It would be to the great advantage of every town.

Mr. A. H. Walker (Loughborough) said the erection of a new destructor had just been commenced at Loughborough. They had had one in operation since

1895, and from that time to the present all the refuse had been destroyed at the sewerage works. Sufficient steam had been generated by the destructor to pump all the sewage, with a lift of about twenty-four feet, on to the farm. At the beginning of last year so much refuse was collected that they were unable to cope with it by means of the existing plant, and his committee, after visiting several towns, came to the conclusion that the type of destructor adopted at West Humberstone, Leicester, was the best that could be erected. They started the work five weeks ago, and he would be glad to show the plant to any members of the Institute at any time.

The Chairman (Mr. W. Whitaker, F.R.S.) said, with regard to the destruction of dust, he had been glad to hear the strong words used in favour of extending their municipal work in that direction. They knew by comparatively recent researches and by the experience of the late wet season that getting rid of dust had a great effect in reducing infantile mortality, and that was a matter which had always presented great difficulties to sanitarians. It was, moreover, a very serious question. In the streets of all large towns they saw children at play and breathing all the dust which was blowing about. They were living in an age of evolution. Last century was one in which the dominant idea was evolution, and a very good thing it was, for if they did not have evolution they would have revolution. They must have gradual progress to save violent spasmodic action. He knew that destructors had been scoffed at because they did not give certain results which some people had anticipated. But a destructor was not primarily a heat producing affair; it was a destroyer. The point to be gained was that it should do its work as a destroyer in an innocuous way in the centre of a town and close to the habitations of the people. The paper which had been read that day was one which should be carefully studied, especially by our younger members. It was a history of progress made in this large town, and was exactly the kind of testimony we wanted to circulate in the Journal of the Institute.

DISCUSSION ON

THE FLOODING OF BASEMENTS IN LONDON BY SEWAGE.

Opened by MAURICE FITZMAURICE, C.M.G., M.A., M.A.I., M.Inst.C.E.,
Engineer to the London County Council;

And Prof. H. R. KENWOOD, M.B., D.P.H., F.C.S. (FELLOW),
Medical Officer of Health, Stoke Newington.

At Sessional Meeting, Wednesday, December 9th, 1904.

MAURICE FITZMAURICE.

I MUST begin my remarks to-night by thanking the Council of this Institute for asking me to open this discussion. The subject which we are to consider is a very large one, namely the Flooding of Basements in London, and I can only consider that the selection of that subject is a way the Council has discovered for enabling us to consider the general question of metropolitan drainage. I speak of the drainage of London advisedly, because there are two kinds of drainage in London: there is the main drainage, which as you know is in the hands of the London County Council, and in speaking of that body I may say at once to-night, although I am Engineer to the Council, and know a good deal about the ins and outs of the drainage of London, I am speaking simply and solely as a private individual, and in no way as representing the London County Council. The London County Council deals with the main drainage of London, but the local drainage of London, a very important question also, is dealt with by the various local authorities, borough councils, and the Corporations of Westminster and the City of London, in their own areas. Both the local drainage and the main drainage dovetail into each other, and are absolutely inter-dependent. If on the one hand the London County Council sewers were not able to carry off the drainage from the local sewers, we should have floodings on both the local sewers

and on the London County Council sewers; if, on the other hand, the local sewers were not able to carry off the drainage while the County Council sewers were able to do so, there would be flooding on the local sewers only.

Unfortunately I, probably more than anyone in London at the present time, have a knowledge of the amount of flooding which has occurred during the last summer. In nearly every case of basement flooding the owner has written to the London County Council, and those letters have come to me. Many complaints have also been written to the Borough Councils, and the Borough Councils have sent on the letters to the London County Council, so that in most cases I have had two letters of complaint about every flooding in London. Some of them have been threatening, some of them have been resigned, and some are written more in sorrow than in anger; but they all naturally want compensation for having their basements flooded, due, as they say, to the London County Council sewers not being able to carry off the sewage. It might interest many people to know what has been done with these letters. A great number of people think no notice is taken of them: but this is what has actually been the case: a large map has been made of London, showing all the streets: from every letter of complaint the position of the house complained of is marked on that map and forms a definite record of flooding in each district. That map will be extremely useful in dealing with the flooding generally in London, because one can see at a glance where the trouble has been severe. In making this statement I hope I shall not be inundated with hundreds of thousands of letters asking to be placed on that map, because on certain parts of it we have got as many cases as we can put on. I have been able to judge from this map how very extensive the flooding of London has been during the last summer. Of course no one can deny that the flooding has been very great indeed. If we consider the north side of the river, the boroughs which have suffered to the greatest extent are Hammersmith, Kensington, and Hackney, and on the south side Wandsworth, Battersea, and Southwark. We can see that the flooding has been bad in a large number of streets, and in many cases has fallen on poor people who are unable to bear the extra expense of having their cellars and goods destroyed in this manner.

In dealing with these floods I divide them into two classes: we first have those floods which are due to the exceptional rainfall of the present year, where the premises have never been flooded before. The second class of floodings are those which have been flooded for several years in succession, and in some cases with increasing result year by year. Dealing with the first class, you must remember that the rain during the

last year has been absolutely unprecedented. The rainfall up to the present time exceeds in many parts of London forty inches for the year, and we have had in one day no less a quantity than three and a half inches of rain in London. We have had several days in which an inch of rain has fallen, and on twelve days during three months we have had more than half an inch of rain in London.

It is not in London alone that this great rainfall has occurred; it has been general all over the country. I daresay many of those present who have travelled on the Great Western Railway during the last few months have noticed that the Thames has spread into a lake for long lengths on either side of the river. There has been great flooding all along the line, but I have not found that anyone proposes, because of these floods, that there should be a secondary river on each side of the Thames all the way down from Oxford to the tidal water. But that would be just as reasonable a proposition as to suggest that we should deal with the floodings that have occurred in London through three inches of rain in a single day by special means: floodings which perhaps happen once in a hundred years. It is quite impossible and, in fact, too expensive to meet such emergencies, and beyond all reason to attempt to deal with floodings of that class; but the floodings of the second class are a totally different matter altogether. These, as I have said, have occurred in past years, and where the floodings increase. As the area in which the rain falls is built over and the rate of flow of rainfall into the sewers increases, so these floodings increase. I think it is only reasonable and right that measures should be taken to put an end to such floodings. At the same time in saying that I should like you to remember the powers the London County Council holds with regard to buildings on low-lying land. In such cases the London County Council has a right to say where houses are being built that no basement shall be connected with the sewers, and that the basements shall be made watertight. That prevents floodings in those districts. I think that is a thing which should be thought about, whether basements in other parts of London should not be dealt with more or less on the same principle. I am quite aware that with the basements in old houses it is almost impossible to do this, because if you cut off the basements from the sewers, you may in many cases have floodings through the floors because they are not watertight. But I think in all houses built in the future it would be only reasonable, as far as possible, that the basements of all houses should be cut off from the sewers. In the great majority of houses there is no necessity for a connection to be made between the basement and the sewer; and if the principle were laid down

that the basements shall not be connected with the sewer and the basement itself shall be made watertight, which is easily done by putting a layer of asphalt over the bottom and sides, at a small extra cost, I think that the floodings would not be so serious as they have been during the past year.

Before discussing the means of preventing flooding in basements, I will ask you for a few minutes to deal with the way in which the main drainage of London has grown up. Before the year 1855 all the drainage of London was delivered into streams which discharged directly into the Thames and, of course, the Thames was in a very polluted state. But that was not the only harm that was done. During high water it was quite impossible for these sewers to discharge into the Thames, and consequently for about twelve hours out of the twenty-four all the sewage backed up in these channels, such as the Fleet Sewer, Counters Creek, and many others which had been old river channels, and in these the sewage lay stagnant for many hours. Sir Joseph Bazalgette was instructed by the Metropolitan Board of Works to deal with this question about the year 1855, or a little later, and he immediately did what was obviously the right thing to do, built intercepting sewers, which, instead of allowing any sewage to flow into the river, carried it out to Barking and Crossness respectively on the north and south sides of the Thames some few miles down the river. In this way the sewage was taken from that part of the river which goes through London to a spot where it can be discharged with comparatively little harm to the inhabitants. Sir Joseph also built a large number of main sewers, which are also under the control of the London County Council. I daresay it will be a revelation to a number of people to know the large number of sewers that are under the Council's care—the total length is somewhere about 300 miles. After all there is no difficulty in dealing with the *sewage* of London by itself, the difficulty comes in when we are dealing with the *storm water*. The main sewers of the sewerage system devised by Sir Joseph Bazalgette dealt easily with the sewage, but the storm water had still to be considered. What Sir Joseph Bazalgette did was this: When the intercepting sewers became full from storm water he had overflows which came into the old lines of the sewers which ran into the river, and he carried the storm water into the river instead of carrying it down to Barking and Crossness. Of course, then he met with exactly the same defect as was met with in the old sewers. During certain times of the tides these overflow storm sewers cannot deliver the water into the Thames, and therefore it has been necessary to build some pumping stations. These pumping stations

are situated on both north and south sides of the river, so that the storm water may be lifted at high tide into the river instead of allowing it to back up into the sewers.

One cannot help looking at this enormous scheme, which was carried out by Sir Joseph Bazalgette, without admiration at the way in which it has lasted, and at the satisfactory state of London during a long period. It is now fifty years since it has been completed, and I am sure Sir Joseph Bazalgette ought to have the credit for the great foresight which he used in the system he adopted, so that until about the year 1890 there was very little to complain about in the sewerage system of London. The population of London at the time Sir Joseph Bazalgette designed these works was about 2½ millions of people, but he looked forward to and provided for a sewerage system which would meet the needs of 3½ millions of people, or an extra million. He also designed the system at the same time to take a quarter of an inch of rain in 24 hours. The population of London now is closely approaching 5 millions, which is 1½ millions more than Sir Joseph Bazalgette designed this system for. We also know the rate at which the rainfall is coming into the sewers has increased. The area for which the rainfall was estimated has remained constant, but as the area has got built over, and the pervious soil has been replaced by houses and roads, the amount of rainfall that comes into the sewers has increased; in fact, the rain comes two or three times more rapidly into the sewers now than it did 20 or 30 years ago. We therefore come to this position: that we have to deal with the sewage of a population of 5 millions, and the sewers were only designed to deal with the sewerage of a population of 3½ millions, and we have also got to deal with the increased rainfall. I would, however, draw your attention very carefully to the fact that it is not a sewage difficulty in these sewers. In dry weather only about one-third of the volume of the sewers is used, whereas a heavy storm coming on may increase this volume by as much as five or six times.

Coming to the year 1889, when the London County Council took over the drainage of London among many other things, one of the first acts of the Council was to have a full investigation into the question of the main drainage of London. For that purpose they chose our Chairman to-night, Sir Benjamin Baker, and my predecessor as Engineer to the Council, Sir Alexander Binnie, to go fully into the question and report to the Council. That report was made to the Council in the year 1891, and the Council immediately gave orders that the necessary plans should be got out and the designs prepared according to what was proposed by Sir Benjamin Baker and Sir Alexander Binnie. Well, dealing with the question of the

sewage of London takes some time, and the preparation of the plans also takes time to be carried out, and it was not until the year 1895 that the London County Council were able to fully consider the plans for the scheme so recommended.

Now there was no difficulty in dealing with the amount of sewage; the difficulty was the rainfall, and many members of the London County Council thought at that time instead of making an enormous new system of main drainage, that it would be possible to deal with floods and storm water alone, and bring that water directly to the river. They therefore put off for some time the consideration of a large intercepting sewer on each side of the river, and they devoted themselves to dealing with the storm water and taking it away from the areas which were flooded. That policy was only partially successful.

There was another matter which was in the minds of members of the Council when they proposed not to make the main outfalls at that time. This was the time when the question of bacterial beds was cropping up, and this no doubt was in the minds of many members who, on the one hand, did not wish to do anything at the outfall works which would prevent them taking advantage of any system of filtration by bacterial beds, and, on the other hand, did not wish at that moment to settle upon any system of bacterial treatment which in the future might be proved to be not all it ought to be. Well, I think the Council were extremely wise in delaying the construction of works on the bacterial system at that time. I do not wish to say a word against that system, but I think it is right to say that even at the present time there are many people who are not sure what is the right system of bacterial treatment.

I had the honour last July of being asked to preside over the Engineering and Architectural Section of The Sanitary Institute Congress at Bradford, and heard many different views as regards the best system of bacterial treatment. It appears there are several systems which several people think the best. I have seen several works in operation in different parts of the kingdom, and I do not think we have got to finality on this question. I should be extremely sorry to see the London County Council at the present moment, much less in 1895, putting down any system of bacterial beds for London. From the remarks made last July on the bacterial system, it seems that the bacterial problem is a great deal more serious, and has a great many more sides to it than any other system which I can possibly imagine at the moment. It is to be hoped, however, that in a short time there will be some finality about this matter. I do not say this at all in any way as opposed to bacterial treatment; quite the reverse;

but I do want to be perfectly certain of what I am doing, and what the Council are doing before any treatment of that kind is adopted.

In the year 1895 the London County Council proposed to deal with the question of the provision of new sewers, and for this purpose they immediately set to work and carried out a great number of works, among which were many storm relief sewers and a new pumping station at Nine Elms Lane to deal with Battersea and Wandsworth sewers, and they also strengthened the pumping power in all their other stations. However, the result was not quite what was wished for, and I now come to the works which were placed before the London County Council by their Engineer in the year 1899, which works are now in progress. In dealing with these I have to say that the London County Council have to take a very much broader view of this question than appears to be right in particular districts of London. It is possible to relieve the floods in Islington, for instance, but what will happen? You increase the flooding in Hackney; while to relieve the floods in Wandsworth you increase the flooding in Lambeth. The London County Council have to consider the matter as a whole. They also have to consider the purity of the river. In 1899 they did consider all these things, and they decided that they would commence with new outfall sewers and new intercepting sewers, and gradually work westward. There was not the least good in starting the sewers at the west end of London if they had not the outfall for them at Barking and Crossness. The Council had also to consider the purity of the River Thames, and there are very few complaints about the Thames now. After the London County Council commenced to send the sludge out to the Barrow Deep, fifty miles below Barking, that took away a great deal of the impurities that were put into the Thames, and it was certainly not advisable to increase the impurity of the Thames by discharging the first rush of storm water, which might probably be only dilute sewage, into the Thames within the area of London. It is quite another matter when you have sewers which will carry off the first storm water and then discharge the rest into the Thames. If the first storm water is discharged directly into the Thames you will soon reduce the river to the position it was in before 1890. I am a very strong advocate of storm water being discharged into the Thames, but only when accompanied by such an increase in the capacity of the sewers as to leave ample room for the first flow of storm water, which is really worse than the sewage, to come down to the outfalls, and after that you can discharge what you like into the Thames, because it will be practically pure rain-water. The first flow of the water into the sewers mixes up the deposits in the sewers, and carries

with it the washing of the streets, and the first flow is therefore just as bad as any sewage which can possibly be put into the sewers, and it would be a monstrous thing to allow this water to go into the Thames. The London County Council spent large sums of money, and are spending a good deal, in sending sludge out to the Barrow Deep, practically out into the open sea, two and a half million tons of sludge every year; and if we allow the storm water, which is only very dilute sewage, to go into the Thames, it seems to me waste of money to send sludge out to sea.

Many people seem to think there is very little being done about the main outfall sewers, but I think this idea can only be due to ignorance. At the present time two new outfall sewers are being constructed from Barking to Abbey Mills, and these sewers are nine feet in diameter. They extend for four miles on the north side of the river. The contract for the next length of this outfall sewer to Old Ford is now under consideration by the Council, and will be let in a very short time. We have under that vote of 1899 constructed a new Hackney relief sewer, and we have extended the middle level sewer, and we have built a pumping station at Chelsea. On the south side the first sections of the outfall sewers, both high and low levels, have been completed. The contract for the next section of sewers, a contract of £295,000, was let last month, and work actually commenced on that contract yesterday. I do not think that anybody can expect improvements in the main drainage of London to be carried out in a moment. I should like to hear what our chairman to-night would have said, supposing the directors of the Forth Bridge had asked him to build that bridge in two instead of five years. I should like to know what he would have said if the Egyptian Government had asked him to build the Nile Reservoir Dams in two years instead of five. It would be just as reasonable to expect large works like those to be carried out in two years as it is to expect the main drainage of London to be carried out and completed in that time. The programme of 1899 involved the expenditure of £1,200,000, and it was definitely stated how much was to be spent in each year. Up to the end of 1903 the amount which was to be spent was £320,000, namely, in from 3½ to 4 years. What has actually been spent is £500,000, so that we have spent £180,000 more than the programme originally laid down by the Council. During the next two years we hope to spend at least another half a million on new sewers. All I can say is that that is a programme and rate of work which no one need be ashamed of. The London County Council since the year 1899, when they found that the storm-water reliefs did not relieve the districts, put their shoulders to the wheel, and they spent as

much as it was possible to spend on the main drainage of London. But before sitting down I should like to give a note of warning. You will probably have these new intercepting sewers coming up to the West End of London in three years' time, and perhaps they will come up before people are aware of it. All I can say is this, that you will be in a very bad state then if the local authorities do not take the bull by the horns, and find if their own local sewers are sufficient to discharge the rainfall into the new sewers now being constructed by the London County Council, doubling the capacity of the present sewers: because, if not, you will have flooding of the local sewers worse than you are having to-day from the main sewers.

Prof. H. R. Kenwood.

WHEN I undertook to contribute to this discussion, I did so under the impression that I could say a great deal with reference to the failure of the London County Council to deal with the most pressing sanitary need of the Metropolis, and as one whose district has suffered a great deal by reason of that default, I felt that I should much like an opportunity of saying it; but I have only quite recently ascertained that my ground for attack has been very much curtailed by the circumstance that the Council has recently been displaying considerable energy in carrying out some of the work which has been recommended by their skilled advisers as essential to be taken in hand for so many years. The information as to the progress of the work might and ought to have been better made known to the general public, having regard to the general and bitter complaints during the passing year of the negligence in this matter.

When an individual or a corporate body repents of its shortcomings and shows an earnest of doing its duty, that is not the time for one to find fault; it is the time rather for congratulations and encouragement; but the London County Council is an august body, which occupies the position of a supervising sanitary authority, and it is not often that one has an opportunity of finding fault with it (for it does much excellent work and it is advised by a very capable staff of officials) but I am not going to deny myself the luxury of indulging in some adverse criticism when the chance does occur; for, however much may be made of the London County Council's recent conversion, it must be conceded that the

dreadful and disgusting experiences of the present year would have been spared the inhabitants of London if the London County Council had not required ten years of complaints and memorials, several reports from their officers, a mandamus issued on the application of the Lee District Board, and a threat from at least one other direction to bring the Council's default before the courts of law, before it could make up its mind to act.

It is to the London County Council that we look for an example of enlightened and where necessary of prompt administration, and neither will be found in the record of their work dealing with the matter which we have under discussion this evening.

Gentlemen, what is the record?

Fourteen years ago the London County Council (who had then only been in existence for about eight months) instructed the Main Drainage Committee to secure the services of an eminent Civil Engineer to join the Engineer of the Council in a thorough examination of the whole sewerage system of the Metropolis.

About fourteen months afterwards Sir Benjamin Baker and Sir Alexander Binnie reported and recommended certain works, including new outfall sewers, at an estimated cost of over a million pounds.

About two months after that the London County Council adopted the Report and ordered detailed plans to be prepared, as the works "*were of so urgent a character that no delay should take place in carrying them out.*"

Nothing, however, was done for another four and a half years, when the Main Drainage Committee recommended that the works should be carried out. An Amendment was, however, carried in the following terms: "That the general enlargement of the main drainage system is not now necessary, but that local floodings need immediate attention."

About two years after this, in response to a deputation from the Metropolitan Sanitary Authorities, the Engineer to the London County Council was instructed to again report. This he did fifteen months afterwards, and in his Report he recommended work at an estimated cost of over one and a half millions.

Six months later a further Conference of the Parishes north of the Thames was held at Paddington, when the following resolution relating to the storm floodings and the attitude of the Council in the matter was passed: "That this Conference, comprising representatives of the leading Parishes on the north side of the Thames, hereby places on record its surprise that, notwithstanding the strong expression of opinion by the Main Drainage Committee of the London County Council and its responsible officers, and the repeated representations of Vestries and District

Boards to the effect that the existing accommodation of the metropolis was entirely inadequate to carry out the work required of it, no attempt should have been made to abate the intolerable nuisance complained of; and further, that this Conference urges upon the Council the absolute necessity of their at once carrying out such works as may be necessary to remedy the above-mentioned state of things."

In December, 1899, the London County Council, upon the report of the Main Drainage Committee, resolved to proceed with the construction of the two new main outfall sewers from Abbey Mills to Barking, and one between Deptford and Crossness, recommended by their advisers eight years previously, and pronounced by them at the time to be of "so urgent a character that no delay should take place in carrying it out." The resolution however was not carried without opposition, for Sir John McDougall moved, and Mr. Idris seconded, an amendment to the effect that "the general enlargement of the main drainage system is not now necessary, but that local floodings need immediate attention, and that therefore the recommendation be referred back to the Committee;" but the better sense of the Council as a body prevailed, and *part of the necessary work* recommended has been put in hand and is now, I am informed, more than half finished.

Those of us who are Metropolitan Medical Officers of Health feel very strongly with reference to this matter of the flooding of London basements with sewage from time to time, and while we must all fully recognise the excellent work which the County Council has done and is doing, we find it difficult to realise why what is undoubtedly the most pressing sanitary need of London was so long practically shelved. The fact that other more attractive schemes, schemes which perhaps appealed more to the general mass of their critics, were meanwhile dealt with, may in some measure explain their neglect, but it does not justify it.

Supposing that in one of the Metropolitan Boroughs the sanitary requirements of the people were so neglected by the local authority that numbers of the residents were compelled to live in dwellings at times flooded with sewage, and that the remedy lay with the sanitary authority, I am confident that the sanitary authority would at once recognise the gravity of the situation and deal with it *promptly* and at all costs; but if for argument we assume that the local authority were in default they would have the London County Council pressing for the necessary improvements. The defaulting authority in this matter has been the London County Council, and many of us who have at times been urged by that body to greater energy in prosecuting public health measures of

relatively little importance compared to the one under discussion this evening, have felt disposed to adopt the biblical rejoinder that they should first remove the beam which is in their own eye.

I for one would have preferred to have seen this great sanitary need of London given precedence over many improvement and re-housing schemes undertaken by the Council, which have furnished very modest results having regard to their costliness.

If it is not a matter of the first importance to keep sewage and sewage gases out of dwellings then I don't know what is. It is the first principle of all our sanitary teaching, and it is the greatest lesson of all our public health experience. The stringent by-laws of the London County Council are very largely designed to guard against this great danger, and the people have been educated to appreciate it.

The present Main Drainage System was constructed to serve a population of 3,450,000 with an average water supply of 31¼ gallons per head, whereas it now serves 36 per cent. more persons with a water supply of from 35 to 40 gallons per head. Sir Joseph Bazalgette's scheme allowed for only ¼″ of rainfall in twenty-four hours, and it did not provide for the enormous increase in the population even within the metropolis, much less for taking in the drainage from the districts outside the metropolitan boundary of such parts as Acton, Willesden, Ealing, Tottenham, Wood Green, Hornsey, West Ham, and East Ham: neither was it contemplated to take any part of the sewage west of Chelsea. It is therefore obvious that as the sewers have become more and more filled up with dry-weather sewage, less space is left for rain-water, and that therefore the nuisance must increase year by year. The dry weather flow of sewage for which the system was designed was 108 million gallons daily, while it is now about 195 millions, or about 80 per cent. more.

The discharging capacity of the outfall sewers for the sewage north of the Thames as compared with the united discharging capacity of the high, middle, and low-level sewers which empty into them, is deficient to the extent of over 20,000 cubic feet of sewage per minute. Clearly the main sewerage provision ought to be at least of sufficient capacity to deal with the discharging power of the sewers that come into it, and it does not require an individual of the light and leading of a County Councillor to understand that there is no local remedy which can be effectually employed for dealing with the results of this state of things, and that the increased provision of both intercepting and main outfall sewerage is the essential step to take.

The failure of the London County Council to recognise this fact, and their culpable delay in giving effect to the recommendations of their advisers, not only endangered the health and comfort of their constituents, but it has occasioned and still occasions considerable alarm and difficulties to those whose duty it is to guard the public health of their sanitary areas.

The vital importance of guarding the soil and sub-soil from fæcal pollution is one of the greatest lessons that our sanitary experience has taught us, and the desire to benefit from that knowledge is responsible for the expenditure of millions of money in the direction of providing for the water-carriage system of sewage removal from houses, and for remedying defects in existing drains and sewers. Yet picture what was suffered to exist in London by the supervising sanitary authority. A state of things which not only leads to the flooding of dwellings with sewage, but also to a very large amount of avoidable pollution to the soil and subsoil.

In the North of London, as the result of this intolerable state of things, numerous complaints and applications for compensation reach the sanitary authorities. Washhouses, workrooms, living and sleeping rooms, underground bakehouses, and cellars are flooded from time to time with from an inch to a foot or two of sewage, and carpets, oilcloths, linoleums, mats, bedding, furniture, and stored goods are injured or spoilt. The flood-waters leave behind a coating of evil-smelling sewage-mud over and under the floors, thus seriously endangering the health of occupants of the dwellings, and necessitating much outlay for repairs and considerable distress among the poorer inhabitants. Compensation is often prayed for and sometimes demanded by the helpless victims. Landlords complain that in some cases it is necessary to keep the lower rooms empty, that tenants refuse to pay rent, and that tenants leave their houses. In one case a complaint was made that a fowl-house had been started upon a cruise and that nine fowls had been drowned. Sometimes it occurs to the sufferers to take the step of attempting to deduct his expenses from the rates, and here is an extract from a letter received less than a month ago by our Town Clerk: "Dear Sir, I herewith enclose cheque for the rates on above house, less £1 1s. 8d. I wrote to the Medical Officer of Health in June last, up to which time we had the overflow from the sewers out in the house three times. As no prompt measures were taken I took them myself, the only other course being to leave the house. The money was spent in having watertight boards put up back and front, with a set of blocks for the maids to get in and out; also for two heavy blocks of lead cast to fit the gullies and prevent the sewage from coming up like a fountain."

The default is almost Gilbertian in its bearings. The supervising

sanitary authority of the capital of the country, which is undoubtedly in the van of sanitation, demands under its by-laws the most stringent precautions against the possibility of the escape of drain gases in or about a dwelling, and by its neglect it suffers the dwelling to be flooded with sewage. The dweller, conscious of his peril, complains to the local authority, which is unable to deal with his complaint, and he then threatens to appeal to the London County Council, when he learns that the court of appeal is the offending authority.

It must not be thought that these floodings, consisting, as they so largely do, of surface water, are therefore comparatively harmless and inoffensive. No one who has had an intimate acquaintance with the matter which comes up from the sewers into basement rooms will be under that delusion; and, indeed, it is common knowledge that the storm waters issuing from the sewers in the earlier stages of a storm are almost, if not quite, as offensive as dry-weather sewage.

As the Main Drainage Committee of the London County Council point out, even the water flowing from the streets after heavy rainfall is as polluted as, and in some cases more so than, the actual flow in the sewers, and the flood discharges which now take place from the storm overflows are of an offensive character.

Another aspect of the question has reference to the River Thames. Every year that the existing state of things is suffered to continue leads to a considerable increase in the fouling of that river as it passes through London, by the existing overflow sewage. The Main Drainage Committee of the London County Council four years ago viewed with some apprehension the danger of the increasing pollution of the river, and they expressed the view that occasionally the effect on the foreshore was such as they could not contemplate with equanimity. I believe at the present time that the storm outlets into the Thames are brought into operation whenever the rainfall amounts to some one-sixth of an inch. The advantages gained by the expenditure of about £150,000 annually in the treatment and disposal of the sewage in London at the outfall works, with a view to freeing the Thames from pollution, must undoubtedly be largely neutralised if the river is not protected from gross contamination with sewage at points higher up.

The fact is the London County Council as a body have only comparatively recently appreciated to the full the great importance of this work, and they therefore did nothing to expedite it. Under great pressure from their officials, the Main Drainage Committee, local sanitary authorities, and the general public, they made a display of being desirous of doing

something by calling for successive reports at long intervals of time, and by taking a few feeble and halting steps. The fact also remains that even now, as I am informed on good engineering authority, they are not doing their utmost. The London County Council will not escape from justly severe criticism until they have taken hold of this work with both hands and have completed it, and until the general public, prompt to forgive and forget, have forgotten the disgraceful conditions under which so many of them were compelled to live for so many years.

Dr. S. Rideal (London) moved a vote of thanks to the authors of the papers. He said that the meeting was to be congratulated on having the subject put before them in such an able way by Mr. Fitzmaurice and by Dr. Kenwood. He had been particularly amused to find his old friend, Dr. Kenwood, who has always been regarded as being a most guarded and cautious individual, taking exception to the progressive work of the London County Council. He had brought home to them that evening the fact that the London County Council, which some of them had been admiring so much during the last few years for the great work which they had done to improve the sanitation of London, was after all open to criticism. It is as well to discuss these matters at the present time in order to stimulate our administrators to further action in the immediate future. It seemed to him that the works under construction will improve matters in London to a very considerable extent, and that after all the criticism which Dr. Kenwood had brought against the London County Council was only in respect of tardiness and delay rather than of defect and want of knowledge. He thought, however, there were one or two things in connection with this delay for which London would have to pay dearly. Some of the low-lying ground and unused land which still remains in the jurisdiction of the London County Council sewerage system, was being built on at the present time ; and had been subjected to these floodings during recent years. They must realise that that land and other made land, land being raised for building purposes, must be infected with organisms which survive for a long time in such soil. These areas, when built upon, must therefore be regarded for a long time as insanitary areas, and the delay in remedying the floodings of London meant that this remaining available land for building purposes in London must be regarded by sanitary reformers with suspicion. As to remedial measures, so far as he could see, the way to prevent serious effects from these floodings is to adopt some method of disinfection after the floodings by polluted waters in basements. No local authority, and certainly not the London County Council, had ever dealt with the matter from that point of view, and it seemed to him they were running a very grave risk so long as the

floodings continued, in allowing the filmy and greasy slimy matters on the carpets, oil-cloths, etc., so ably described by Dr. Kenwood, to dry and finally be blown about in these basements. This was a very great risk, especially in the summer time. Fortunately, this last summer had been a cold summer, and we had not had following the floods a hot sun to dry up things very rapidly, so that people have had time to clean up and remedy the matter. If there had been a dry wind and a hot sun immediately after the floods, the filmy and greasy slime left by the floods would have dried to dust and been blown about by the wind and might have caused serious epidemics of disease. One other subject, which had not been discussed by Mr. Fitzmaurice, he had no doubt the London County Council were considering in connection with the important works now in progress, and that is dockising the Thames. If that great scheme ever comes about, it seemed to him, this problem of flooding would be aggravated. He had practical experience of the very unsavoury, dangerous, and poisonous character of the first flushings from the streets. Some years ago, he had occasion to examine samples taken from Victoria Street, Westminster, and of all the filthy fluids he had ever examined in his laboratory these liquids were the worst. Possibly motor cars and better street flushing would diminish the evil, together with different methods of road sanitation, with the oil treatment and so forth, and possibly a disinfecting remedy could be applied. But at the present time the street washings were most objectionable. Judging from the London County Council reports, these fluids from wood pavements are very objectionable to treat at the outfall works by bacterial methods because of the wood fibres and straw from the horse droppings choking the bacterial beds, unless a sedimentation or septic treatment is first resorted to. He did not like to say that, although some of these street washings go into the main sewers, this was a reason for a very considerable quantity going into the Thames; but he was quite certain some of it at present found its way into the basements of houses.

MR. W. KAYE PARRY (Dublin), in seconding the vote of thanks, said that what he had been anxious to hear had not been touched upon that evening, namely, the legal aspect of the matter. As a civil engineer practising in Ireland this matter had been brought home to him particularly, and since he had been in London he had come to the conclusion that the London citizens must be a very long-suffering community. If the same conditions had prevailed in Ireland he did not think they would have submitted so quietly as had been done in London. The sanitary authority for a small town in Ireland was recently brought before the Courts for flooding the basements of some houses, and an injunction was sought in the High Court to restrain them from doing injury to the property and creating dangers to the health of the inhabitants. This case was dismissed upon its merits, but he thought the lesson there taught was that there should be some enquiry as to the legal obligations of sanitary authorities in respect of such

floodings. It was a point worthy of consideration as to how far these authorities could be held liable for the injury which is undoubtedly caused by the floodings of basements.

Dr. W. Butler (Willesden) endorsed Dr. Kenwood's description of the subject as being the most pressing sanitary need of London. Every Medical Officer of Health in the neighbourhood of London who had had experience of the insanitary state of affairs produced by these continual floodings was aware of their serious character, and he, in his own district, could not recall a period when the conditions were more serious. He had seen beds floating about, walls knocked down, and 3 feet of sewage in occupied rooms. In bakehouses he had seen the flour bags standing three quarters high in sewage. In one case in which a public house was flooded it was found that they were actually drawing dilute sewage instead of beer. He was Medical Officer of a district which had not sent its complaints to Mr. Fitzmaurice, and it was a district a large part of which drains into the metropolitan sewers, though they were not represented on the London County Council. He could sympathise with Mr. Fitzmaurice because it was his misfortune to have to intercept these complaints. It was distinctly dispiriting to sanitary and health officers to find, directly a new drain was laid and completed to their satisfaction, that the owners of the house came and complained of flooding. The trouble was so grave in the case of underground bakehouses that he had to advise that no underground bakehouses subject to flooding should be certified in accordance with the new Act. This seemed rather hard when in all other respects they complied satisfactorily with the conditions of the Factory and Workshop Acts, and with the standard of the local authority. He had had to solve the problem locally, and this was an aspect of the question which had not been dealt with. He believed it possible in a district subject to flooding, where special circumstances demanded it, to prevent the flooding of underground dwellings. The system he had adopted was to reduce all drain openings to a minimum. Where there was a w.c. that was raised above the maximum flood level, iron drains were insisted on, and a ball valve gully substituted for the ordinary one. It was necessary to construct the manhole of exceptional strength, to have a screw-down cover, to insist that it shall be water-tight, and to anchor-bolt the manhole cover to the brickwork. The pressure to which the whole drainage system is subject is so great that nothing but strong work would stand against it. He believed where these conditions were complied with it was quite possible to prevent floodings of, at any rate, such a dangerous character as those these measures sought to remedy. Floods were rarely caused by a long continued, even severe, rain; it was the quick, heavy rainfall, which perhaps lasted only fifteen minutes, that most frequently caused floods. The sewers back up so rapidly in these circumstances that floodings occur, and very frequently after the rain has ceased. There was thus little objection under such conditions to having a ball valve gully because

they did not get what might be expected, flooding from the rainfall, but if owing to continuance of rainfall they did, it was certainly preferable to having floodings by sewage. He rather differed from Dr. Rideal's suggestion as to the use of disinfectants, because he did not see what value these could be in dealing with the conditions which flooding leaves behind it. There was not merely a silt left on the floors and walls, but in every crevice and nook beneath the flooring, and the use of disinfectants might induce a false sense of security without having removed the actual source of danger. With regard to the effect upon the public health, one portion of his district had been subject to floodings, and it was a fact that in that area the death rate was twice as high as it was for the rest of the district, though, of course, he could not say whether that was entirely due to the floodings, as many other circumstances might contribute to the higher mortality.

MR. C. H. COOPER (Wimbledon) said they ought to be much obliged to Mr. Fitzmaurice and Dr. Kenwood for the way in which they had opened the discussion. He must differ from Mr. Fitzmaurice on the point as to the rainfall this year being exceptional, so far as being liable to cause flooding was concerned. He had prepared a table showing the months since 1853 in which the rainfall in Wimbledon had exceeded five inches. In the year 1855, in the month of July there were 7·87 inches of rain, and in October, 1880, there were as much as 8·46 inches, whereas the greatest rainfall in any month of this year was in June, when there were 6·12 inches. Mr. Fitzmaurice was right in saying the total rainfall of this year had exceeded that of any previous year, of which we have a record, but the rainfall that leads to floods, namely the heavy rainfalls for a short period, has been just as great in other years as it has been in this. For this reason he did not think they ought to discontinue remedial works because of the alleged exceptional rainfall of the present year. The rainfall which had led to floodings was not as exceptional as people tried to make out. With regard to Dr. Butler's suggestion as to ball valve traps being relied upon to prevent flooding in cellars he altogether differed from that statement; such traps might last for a certain time, but sooner or later a storm would occur when there was something wrong and the flooding would occur as before. The floodings that had occurred this year he was afraid in very many cases were due to neglect. That certainly was the case in regard to most of the rivers throughout the country, and it was very much the case with regard to the Thames, which had been sadly neglected. The low-lying lands along this river and many of the islands had been raised, thereby reducing the area available for the flow of flood water. In the districts outside the metropolis there were powers to prevent houses being erected at low levels. He thought it was a great pity the London County Council did not acquire such powers, as at present the only power the London County Council had was to prevent houses being erected below high water mark. Wherever cellars could be prevented this should be done; he did not see why we should go

back to prehistoric times and live underground, as too many people did in the towns to-day. With regard to the London sewer overflows, he did not think Dr. Kenwood was right in saying that the storm overflows discharged at one-eighth inch of rainfall. According to the late Mr. Santo Crimp, M.Inst. C.E., the London overflows only took three per cent. of the total amount discharged by the sewers. If that was so, one-eighth of an inch could not possibly set the storm overflows going. It always occurred to him it was a great pity that the London County Council did not make more use of the overflows than it does. Mr. Fitzmaurice was quite right in saying the high tide affects these overflows, but there were a number of the higher districts where the old river beds might still be used with very great advantage. It seemed ridiculous to him to go on spending money in taking the storm water right down to Crossness and Barking when it might be discharged into the rivers close by. It was true the first street washings were very offensive, but after the first discharge a great part of the water could very well be sent into the river. He had known the Thames for many years, and could remember during the eighties when the mud banks were in a far worse state than they are to-day.

Mr. Francis A. Dod (Stoke Newington) said he had been most interested in the speeches which had been delivered, and could not help feeling that the London County Council was responsible for the present state of affairs. He submitted that they were the chief sanitary authority of London, and as such their first thought should be for the health of the inhabitants. A report had been made by Sir Benjamin Baker and Sir Alexander Binnie, but Mr. Fitzmaurice had not told the meeting what that report was. They could well imagine what it was by the resolution of the London County Council on the 14th April, 1891, when they adopted it and gave instructions that detailed plans should be prepared, and the works being of so urgent a character that no delay should be made in carrying them out. Under these circumstances he would ask the Chairman to allow him to move the following resolution: "This meeting is of opinion that the flooding of London basements with sewage is a grave menace to public health, and regrets this menace has been allowed to continue for so many years, and requests the Council of the Institute to urge the London County Council to proceed with all possible expedition to the completion of the necessary works upon the main sewers, and so relieve London from its present insanitary state."

Mr. W. F. Loveday (Stoke Newington) said he was very interested to know what the London County Council were doing. It seemed to him that Mr. Fitzmaurice had a very thankless task to perform that evening in excusing the misdeeds and sins of omission on the part of the London County Council in years gone by. He had hoped to have heard what the capacity of the sewers was at the present time, and what they were at the time the London County Council

came into existence, and he would also like to have known if the London County Council had done anything since they had been in existence to mitigate this evil of flooding. Judging from what Mr. Fitzmaurice and Dr. Kenwood had said, the London County Council had apparently done nothing to increase the capacity of the sewers and yet as far back as 1891 two eminent experts reported to the Council and showed that the outfall was 3,300 cubic feet per minute deficient. Reference had been made to the excellent work of Sir Joseph Bazalgette who had designed this system for a population of 3½ millions. The London County Council were perfectly well aware of that, and not only so, but that the outside districts of Acton, Willesden, Tottenham, Wood Green, Hornsey, East and West Ham, participated in the metropolitan main drainage system. All these districts had their sewage put into the metropolitan sewers, and thus the sewers of London had had something like 80 per cent. of dry sewage flowing beyond what was expected by Sir Joseph Bazalgette. The London County Council must have been aware of this, and it seemed to him also that consequently they were to blame for having allowed so many years to have gone by without having sought a remedy. London ought to be grateful, at any rate, that the Council now attempted to grapple with the subject, and the only thing to be done was to see that the central authority was kept up to the mark, and not be allowed to lag behind after the excitement of this year's record rainfall had passed away. He seconded the proposition of Mr. Dod with very great pleasure, and hoped that it would be sent on to the London County Council showing that The Sanitary Institute have not been remiss with regard to the matter by keeping a watchful eye on them as well as on the London Boroughs for the benefit of the inhabitants.

Mr. J. S. Hodgson (London) observed there was one point not referred to by Mr. Cooper in connection with his contention as to the rainfall of the present year not being so exceptional as was thought. It must be borne in mind that the amount of impervious surface in the metropolitan area had largely increased, so that the actual effects of the present year's rainfall might be exceptional, so far as the main drainage system was concerned, even on the basis of Mr. Cooper's comparison. All his experience led him to agree with Mr. Cooper that a large amount of the rainfall of London might be reasonably discharged into the Thames, on both sides of the river. It appeared to be the general opinion that a separate system for London was an impossibility, a view maintained by all who had been officially connected with the subject. American experience was, however, in favour of a separate system. In Boston a combined system on the same basis as that for London had been put down, but since the construction of the city's main drainage works, steps had been taken to put the system on an absolutely rigid separate basis, and within the next ten years there will not be a combined system in Boston.

The Chairman (Sir Benjamin Baker, K.C.M.G., F.R.S.) said it would be his duty to put the vote of thanks to the meeting before dealing with the resolution proposed by Mr. Dod, and he was quite sure that whatever difference there might exist in the meeting as to the opinions raised, they would be united in the vote of thanks. Mr. Fitzmaurice had not been long in office, but he had been personally known to him (the Chairman) for many years. In fact, from the time Mr. Fitzmaurice had left College they had been friends, and he could assure the meeting that if energy could do that which the meeting wanted, then they had the right man in the right place in Mr. Fitzmaurice. To some extent the views on the part of the meeting in the resolution urging attention upon the London County Council had rather been discounted by Mr. Fitzmaurice in his opening remarks as to what the Council were doing. But he quite agreed that it was useless thrashing a dead horse and regretting the delay which had occurred since the date of his report, and the London County Council had so many irons in the fire and so many different interests were pressing upon it that he quite understood why the more costly of the recommendations in the joint report of Sir Alexander Binnie and himself were delayed in the first instance. Those recommendations involved very large expenditure on the part of the ratepayers, and if by dealing locally with the floodings the evil could have been remedied, that policy would have been a popular alternative to the electors of London. Events had shown, however, that with the greater population and the increased floodings caused by water running off pavements and roofs and other consequent developments of a great city, that the large measures which were then recommended must now be carried out. While, as he said, it was no good thrashing a dead horse, he had not the least objection to giving a touch of the spur to a live one. Mr. Fitzmaurice had told them he was going on with the work as rapidly as possible, and he did not think it would do the least harm to the London County Council if there was a little pressure put on by The Sanitary Institute to urge them to go a little faster than they contemplated. If that was so he was sure Mr. Fitzmaurice would be the last one to regret it. He quite understood that the resolution proposed was not intended in any hostile spirit to the London County Council or other officials, because it must be admitted that it is an intolerable trial and nuisance to have sewage in basements, and a little plain speaking must be expected. It was quite unnecessary to enlarge upon a point like that, because the nuisance was obviously intolerable to those who had suffered from it. He was sure they might accept Mr. Fitzmaurice's assurance that this fact was now fully realised by the London County Council, and that every possible effort, whether the resolution was passed or not, would be made by the Council to remedy the matter as soon as possible.

Mr. Fitzmaurice, in acknowledgment, said he did not know there was very much to reply to. He was glad to find that the complaints against the London County Council had boiled down to the fact that their main drainage work was

not sufficiently advertised. There were only two points which might be referred to, one which had been already pointed out with regard to the rainfall of 1855, when the population of London was 2½ millions, whereas now it was nearly 5 millions. They had increased the number of streets and many buildings had been completed since that time, which enabled the rainfall to run off the ground 3 times as quickly as in 1855, so that it was quite ridiculous to compare one year with the other. The other matter was not a matter spoken about at all and hardly a matter for discussion there, but probably some members might help him in a very difficult matter, that was, not the entrance of sewage water into sewers, but the exit of gas from the sewers. Considerable complaints were made as to the smells which came up from the ventilators on the surface of the streets, and no doubt it was most objectionable. At the same time, they must remember there was a large army of men at work in these sewers under the streets of London, and unless there was some means of ventilation for these sewers it would be impossible for them to do the work. In some cases he had asked the Borough Councils to allow him to put up ventilating shafts, perhaps a ventilator of 12 in. in diameter, in order to remedy the smells in the streets. In many cases permission had been refused, and he could only say as far as he was concerned he would decline to advise the London County Council to close any ventilation opening on the surface of the streets unless he could get another to take its place. He was responsible to the Council for the lives of a large number of men: only the other day he had two men pulled out of the sewers senseless from the gas which had developed there. Several times during the last few years they had had the men badly burnt through explosions of gas in the sewers coming from different works, such as petroleum works and so forth. These men must have lanterns and explosions had occurred in that way. If those present would try to help him in the ventilation of the sewers and get the authorities to allow and give sites for ventilating columns so as to avoid this unpleasant gas coming up to the road surface, they would do something to preserve the lives and health of a large number of men who worked underground in the sewers.

DR. H. R. KENWOOD (London) thanked the meeting for the vote of thanks which had been passed, and said he hoped he had made it quite clear that so far as the officers of the Council were concerned, and so far as the Main Drainage Committee of the Council were concerned, he thought their record was beyond reproach. What he found fault with was that the London County Council as a body should have delayed taking action in respect of such a pressing matter. Mr. Fitzmaurice had given a most interesting account of the work, but he thought the meeting would agree that Mr. Fitzmaurice had not said anything which excused the London County Council for their neglect and default for a period of ten long years after they had received a valuable report from their experts, and had themselves expressed the view that the work was "urgently

necessary." On that account he hoped the resolution proposed and seconded would be passed. London had reached the limit of its suffering and inconvenience in this matter, and the resolution coming from The Sanitary Institute, if approved by the Council of the Institute, would have weight, and possibly some effect in still further pressing on the work. No doubt the London County Council, during the last two or three years, had been doing a great deal towards remedying the evil. On the other hand, nothing would be lost by passing the resolution that evening, and it would probably do good in reminding the Council that London is earnest in this matter, and expects them to take hold of the work with both hands.

The Chairman said that, in accordance with the rules of the Institute, the resolution passed at a sessional meeting would have to be submitted to the Council to be dealt with as they might deem necessary, and he would therefore read the resolution: "That this meeting is of opinion that the floodings of London basements with sewage is a grave menace to public health, and regrets this menace has been allowed to continue for so many years, and requests the Council of the Institute to urge upon the London County Council to proceed with all possible expedition with the completion of the necessary works upon the main sewers, and so relieve London from its present insanitary state."

Note.—Resolutions passed at meetings of the Institute can only be in the form of recommendations to the Council, to whom they must be submitted for consideration and approved before they can be considered as the official opinion of the Institute.

Notes of the decisions of the Council on the resolutions are given at p. 153.

DISCUSSION ON

THE VENTILATION OF BUILDINGS

(Including Public Halls and Churches, Theatres, Factories, Hospitals, and Schools).

Opened by EDWIN T. HALL, F.R.I.B.A.
(Fellow and Member of Council),

At a Provincial Sessional Meeting at Manchester, January 29th, 1904.

FIRST of all I think it is of very great importance that we should clearly define what we understand by the word "ventilation." It is, as I understand it, the passing through a room fresh air, without draughts, in such volume and at such temperature as may be necessary for the sanitary comfort of the occupants. I have laid stress upon the word "through" (passing through the room) because we can get no true ventilation by merely admitting air into a building unless we supply the necessary exits for it. That has been demonstrated again and again, but one very simple illustration of it is in connection with tests as to the porosity of walls. An external wall of brick or of stone is not an air-tight barrier, but merely a very slow filter. Professor Pettenkofer was, I think, the first who drew attention to this, but quite recently there was a very good illustration of the fact in this way: In a room with all the inlets and outlets sealed, candles were burned, and by the quantity of carbonic acid which they evolved chemists were able to ascertain the amount of fresh air that came in. It was found that under those conditions the volume of air contained in the room was renewed, that is to say replaced by fresh air, in periods, according to the wind, of from about an hour and three quarters to a little over three hours. But the moment the register in the fireplace was opened the air came in at double that velocity, in other words the air in the room was renewed in less than an hour; and when a fire was lighted, with no other inlets but through the wall, it was renewed in the fifth part of an hour. That shows the necessity and the great benefit to us of having through currents of air and not merely inlets. Now another general observation I should like to make is this, that no one system of ventilation is applicable to all types of building,

nor to all purposes for which any one type of building is used. Again, I should like to remark (of course it is known to you, but for the sake of making clear what I may say later on I should lay stress upon it) that the air is practically one ocean. No matter whether it be in the country or whether it be in a city like Manchester, it is the same air, and it is astonishing how little it differs in purity. For example, in the country, in Scotland, numerous tests showed that practically the amount of carbonic acid (CO_2) which was in the atmosphere was about three volumes per 10,000, whereas in London it was only 3·5, and in most of the large cities in England it did not exceed about 4. Of course I am not speaking of abnormal conditions, but of the normal atmospheric condition of the cities. That being so, we may assume that wherever we are we have practically pure and free air, an ocean from which to draw for the purposes we require. A fallacy that it is just as well to mention, because we were all taught it many years ago, is that owing to the great specific gravity of carbonic acid it falls to the ground, and therefore at a given height above there is less impurity, less danger to breathing, than if we are lower down. Well, that has been conclusively proved not to be the case in rooms of moderate altitude. Probably this would not apply in such a building as a church, but only to the rooms in which we are ordinarily assembled. A great many tests have been made, and it has been shown that the CO_2 at a foot above the floor is practically the same as the CO_2 at a foot below the ceiling, and in the intermediate space too. Then another point is velocity. We cannot let cold or warm air come in at a great velocity without discomfort, and I think that for practical purposes it is not desirable that air should come in at a greater rate than three to four feet per second. My last general observation is that we should have no unventilated space in a room. In other words it is as necessary to scour the corners of a room as it is to scour the centre of a room, and that may be done either by artificial or by what is usually called natural ventilation.

Having made these general remarks, I will turn to the first and simplest type of building of which I have to speak. This is the ordinary house. Now, we must be practical people, and we do not want to introduce into a house great and expensive systems of ventilation when we can normally do without them. The things, therefore, to remember are:—

1st. That in rooms we should keep the top of our windows close up to the ceiling, and not leave a big space above them. If the windows were kept down two or three feet we should not get the scour which we require;

2nd. It is not desirable in any room where there is a fireplace with a

fire going that cold air should come in at the floor level; because naturally the fire is a very strong aspirating influence, and it would draw the cold air straight to it and everyone's feet would be cold;

3rd. Sometimes, owing to gales of wind and other causes, it is not always pleasant to open a window in a room, and then we want some kind of tube to let in the air. The ordinary Tobin tube is, as we are aware, a tube which generally runs up inside a room (an unsightly thing) and it draws its air, if the room is on the ground floor, from close to the ground. Manifestly, therefore, it is drawing its air from a polluted source, in that the ground air which is given off contains a good deal of CO_2. My own practice has always been to build an L-shaped tube into the outer wall, starting from about six feet from the floor, bringing the inner arm up about eighteen inches, with a sloped roof, and a vertical sheet of gauze at the upper part, with a little door at the bottom for cleaning out the tube. The gauze is beneficial because if cold air is cut up into very fine spray there is not that draught which we have if it enters in a dense current. The best of all ventilating apparatus for aspirating is an open fire, but it is desirable to have some other form of outlet into a separate flue alongside a warm flue, making the outlet close to the ceiling, so that the heated air may pass away. I should also remark that an essential thing for the comfort of a house is to have the hall and staircase warmed. This may be done either by an open fire, which is excellent, or it may be done by hot-water radiators. It should not be done with an iron stove with a fire in it, because, if the wind is very strong, aspirating the air through the flue makes the stove red-hot, and I think chemists will tell you that you would then get carbon oxide into the air, and that is a very deadly poison indeed.

Now, passing from the ordinary house, I will just give a glance at houses of a larger size, such as Homes which are provided for nursing institutes, and other buildings of this sort. It is manifest that when you have a building containing, as in the case of some of the institutions to which I am architect, 200 or 300 bedrooms, it is a great cost to have fireplaces in each room; it involves a great deal of labour in carrying up fuel, and further there is a great deal of dust generated. Therefore, I think in such rooms a very good system is to heat them by hot-water pipes, with perhaps a radiator in the room (it depends upon its size) to have fresh air laid on to the radiator, and to have an aspirating flue near the ceiling going into a big duct which eventually ends in a shaft at the roof, and in that an electric fan. By this means we insure a current of air through the room, which is sufficiently warm to be comfortable; the heating is inexpensive, and you save that pollution of the

atmosphere which 200 fires of ordinary coal would cause. All our efforts as sanitarians should be given to minimise the throwing of soot into the atmosphere of towns.

Passing from Homes and coming to Public Halls and Churches, we have a very different set of circumstances from those of the homes and private houses which we have been considering. In the first place, we have to deal with a crowd of people. These are at rest (I am afraid sometimes in repose) but, at all events, they give off in such conditions much less carbonic acid than they would if they were actively employed, as in workshops; and therefore we must differentiate between a lot of people in an assembly and a lot of people at work in a factory. But each person in a big room is a furnace giving off heat and, further, giving off capillary and respiratory emanations. I will not weary you with a lot of figures, but I believe chemists tell you that a thousand people give off, among other things, the equivalent of eight gallons of water in aqueous vapour in the course of an hour; and, further, that the breath which these respire gives off a greater percentage (I think it is about $3\frac{1}{2}$ per cent. greater) of CO_2 than that which is contained in the ordinary atmosphere. Then they take up so much oxygen. So that as a matter of fact they are technically fouling the atmosphere. We have generally in such buildings (I am not speaking of a hall scientifically built, like the one in which we are gathered, but in such buildings as we see all round the country) we have very frequently shaft ventilators in the roof, but no means for the inlet of fresh air except the windows; and it is manifest that people sitting closely packed together, cannot have a window open pouring cold air down upon them. Well, with these aspirating flues, these shafts in the roof, the wind pulling on them, as it does pull sometimes, so attenuates the atmosphere, which is, of course, elastic, that if the audience is standing up and suddenly sits down, the action is that of a piston, and down comes a big draught. Moreover, if we have two or three of these shafts one will act as an inlet and another as an outlet, and so we get not only draughts but alternations of heat and cold. One very frequently sees furnace chambers for heating air in the basement, with gratings above in the floor of a hall. These grating-inlets are very nice if one sits close to them, but the hot air simply rises to the top of the building in practically a vertical column, and the people who are sitting a few yards away have no benefit whatever from it. Then we have sometimes steam heating. Personally, I think steam heating is very objectionable, either by pipes or by radiators. You cannot get a steam radiator to a less temperature than something like 215 to 220, but if you use hot-

water radiators you can maintain these at a temperature of 150 or 160, and air so warmed has not that burnt or dry taste which you find from steam radiators. The difficulty arising from the drying of the air by the steam radiators is very often met by placing bowls of water on them. This is a very crude and unscientific way of remedying an evil. I remember some time ago going over a large institution at Munich with the medical chief, who told me they had to be always putting cold water vessels on their steam radiators, because the air was so dry that it was unpleasant to breathe.

I have already mentioned the evil of stoves. Stoves give a certain amount of heat locally but the danger from the carbon oxide is present. Another thing I would ask you most carefully to avoid is having floor channels with any system of pipes. Sunken floor channels always become receptacles for dust. The men in cleaning the room cannot help but brush into them, and gradually they became very foul indeed. It is all very well to say they may be cleaned, practically it is almost impossible to clean them if there are many pipes in them. If you must have air-inlets at the floor in such a place as the centre of a church, you can put under the seats raised platforms, with vertical risers, fitted with iron gratings perforated to suit the proximity to or distance from the source of heat. By that means you get the air delivered in a pleasant way at the floor level without the danger to which I have just alluded. As a rule I think a church may be admirably heated by having hot-water pipes around it with radiators placed underneath the aisle windows, in cases closed except at the top, the fresh air entering the case from the back, passing through and over the radiator and entering warmed into the building from the top. The warm air coming up meets and warms the cold air from the window or prevents the chilling of the air, which results in a down draught. But you often find great cold coming from the clerestory windows of a church, and it is most useful to run hot-water pipes underneath these windows for the reason already given.

Nowadays one often hears of the plenum system of heating and ventilating, but in my judgment it is not applicable to a church, though in new public halls specially designed the system might be advantageously employed.

In a church (and the same remark applies to a public hall) it would be sufficient if you made provision for the inlet of about 750 cubic feet per person per hour as low down as you can to the floor. The space should be heated to a temperature of about 60 degrees before the public come in, and when they are seated that temperature might be lowered,

so as to allow for the heat which is given off by the people themselves. You would then get a very pure air and you could arrange for its inlet at a low velocity. The warm air would rise with the respired air, and if the roof of the church were constructed in the ordinary way the air would find sufficient outlet through the cracks in the boarding of the roof. If this were not sufficient you could put in an aspirating shaft.

The next type of building I should like to deal with is a theatre. A theatre is an exceptional room. It is practically a place with no windows whatever in it, so far as the auditorium is concerned; it is very frequently surrounded wholly or partially by corridors; it has many galleries; and I think no system of heating and ventilation is of any value except the plenum, a system consisting in filling the space with fresh air by propulsion. The foulest places in theatres are not generally the pit or the stalls or the first circle, but if there are several balconies you will generally find it to be the foulest underneath the top balcony in the theatre. The gallery itself would not be nearly so foul as the balcony immediately beneath it. The balconies are very frequently constructed with a ceiling sloping upwards from the front towards the wall. This creates a pocket which is practically always unventilated. The heat there would be intense and you would find the air there would be very bad. Now if, instead of that, the balconies were constructed with a slight slope up from the wall to the front no such condition would arise. The air would then be driven out on the slope towards the centre of the theatre. The way in which plenum heating ought to be applied in such buildings is not by one shaft letting in fresh air. In my opinion this is ineffective. As a general rule I should recommend four, five, or six at different parts of the periphery of the auditorium under the balconies. By this means you would I think get the propelled air well distributed. The force is from the inlets towards the centre or open part of the theatre. The vitiated warm air would then rise with the ventilating influence, going from the people towards a central shaft. The shaft may be aspirated either by gas or by electric fans, which I think are the better. If this were done and the balconies constructed in the way I have suggested, I venture to think you would get an infinitely purer air than you ever find in an ordinary theatre.

The temperature of the atmosphere in an unventilated theatre rises to a great height, 73°, 74°, 80°, and very often I think you will find the CO_2 in such places is 23 to 30 volumes per 10,000, and it may be higher; the corridors and the halls all round should also be ventilated, and I think that their temperature should be somewhat less, but only a little less, than

that of the theatre, in order that these may have a tendency to ventilate towards the theatre without draught, so as not to act as a baffle on the plenum system, by which one is endeavouring to drive the air towards the centre of the theatre. The pit and the stalls can be heated in the way I have spoken of for heating churches, by having raised little platforms under the seats. The stage itself is a difficult matter. The stage should be cooler in temperature than the auditorium. If it is warmer all the vitiated air of the theatre drives on to the stage; if it is cooler a current would be set up which would not only assist the volume of air in rising in the theatre to the aspirating flue, but it would also assist the voices of the actors by carrying them towards the audience. Of course in a place like a stage there are doors opening, there is a great movement of scenery, there are the actors and the actresses, and the ballet dancers all causing a great movement of air. If doors are open from the street leading direct or by the corridors to the stage there are great draughts, bad for the actors and very objectionable to those who sit in the front part of the stalls or of the house generally. But if by radiators (which I think would be the simplest way of doing it) you were to heat the air as it comes from the external doors towards the stage you would, I think, get quite sufficient warmth for the purpose, and you would assist the ventilation of the theatre itself.

Passing on I come to factories. Here you have again an essentially different set of circumstances to those of the public hall, the theatre, or the church. You have people actively engaged: and a man actively engaged in manual labour gives off a great deal more CO_2 than when he is at rest. I believe it is something like double. In such places it is desirable to give a much greater volume of air than in a church. In the latter case I suggest 750 feet, but I think it ought to be 1,100 to 1,300 in a factory, the quantity depending upon what the people are doing. Cubic space per person is often looked upon as the great desideratum in giving them healthful conditions, but that is a great mistake. Professor John Scott Haldane some time ago showed that in a room where there was 10,000 cubic feet per person the results he obtained of CO_2 were worse than in any other place he had tried. I believe there were 16·5 volumes of CO_2 during daylight, and as many as 56 volumes per 10,000 when the gas was burning throughout the place. That was with 10,000 cubic feet per person!

Again, as I said at the very outset, all systems of heating are not applicable to every factory. In some processes of manufacture they find it desirable to exclude all fresh air, that is to say, air from the outside,

because of its injury to the fabric which is being manufactured. Then there are other processes. I think there is one which is called "gassing." It is a process by which some silk goods in process of manufacture are heated over gas, and there the fresh air which is required for the operatives is absolutely cold air, to neutralise the great heat which is given off from a gas apparatus. I have spoken to you earlier as to the porosity of a wall. Where there are large sheds and the superficies of the wall are small in relation to the area of the building, the atmosphere appears always to be worse than where the wall superficies are larger. Probably it is because you cannot get the requisite volume of air through the walls. I have mentioned to you about the bad results obtained in the large room with 10,000 cubic ft. per person. In a room where there was only 760 ft. per person (it is true they were sitting still and reading or at sedentary work) the worst they got with every inlet closed in the building was 15·3 volumes, as against 16·5 with 10,000 cubic ft. per person. This means, in effect, that the air in the large room with the 10,000 cubic ft. was only changed through the walls once in 24 hours, and this, of course, is exceedingly bad. Where operatives are using or working printing or similar machines they want a large volume of air, but they want it warmed to about 60 degrees. In a big shed, again, I think the only system of heating and ventilating which is applicable is the plenum, and I suggest that where there are many rows of columns a good arrangement would be to have, above the level of the head, horizontal ducts in which the warmed air could be carried to different parts of the building and distributed all over the place, so as to give to each operative, no matter what his distance from the external wall, fresh air such as he requires for his work. Then I would say that there should be no lifts or staircases within any factory, however high it may be. If there are, they simply become ducts of foul air, bringing up CO_2 from the lower floors. I have here, by way of illustrating my point, a plan of printing works that I designed some years ago in London. There are large rooms arranged in the form of a T, and between the arms I had an open balcony with a lift at each end of the balcony. They served every room all round quite conveniently, but they were external to the building, by which means they could not possibly convey foul air, nor were they a source of danger from fire. In like manner the staircases in these works were all external to the rooms and open to the fresh air from bottom to top. These are simply illustrations which show how one can apply the principle recommended.

I have now to speak about Hospitals. In hospitals the condition of the occupants is, of course, different from that in a factory or in any of

the other buildings that I have been dealing with. The patients are necessarily in weak health, and they are very few compared with the cubic space. The cubic space that is given is often, I think, much in excess of what is necessary for ventilation, but the object of the large space is, I think, to give convenience of access to the patients, plenty of room to get about them, to move their beds, etc. The ordinary ward as modernly constructed is a building that has windows on both sides. It is surrounded by air, it is flooded by sunlight, because generally the axes are placed north and south, by which means are obtained east, west, and south windows. In my opinion in such buildings it is very undesirable to have a plenum system of ventilation. I think it is infinitely better that patients should have open windows and, in any case, an abundance of fresh air drawn as nearly direct from the sunlit ocean as they can get it. What is the first thing you do with a convalescent? The first thing the doctor says is "Go into the open air, the fresh air, as soon as you can." I think an evil of the plenum system in a hospital is that it teaches patients to live with closed windows, which is absolutely opposed to what the doctors are trying to teach. Take the very prevalent disease, tuberculosis. To cure this, doctors are everywhere advocating open-air sanatoria, where the windows are always open, no matter what the weather may be.

Every story of a hospital should be separate from another. Where it is possible I advise you to keep the building without an enclosed staircase leading from one story to another. The staircase is better detached if you can so arrange it. In like manner the corridors should be open.

As to Schools, it is a very general and quite a modern practice to make the assembly hall with class-rooms opening from it. I think it would be much better, where space permits it to be done, to have the hall quite separate. In the Bluecoat School (Christ's Hospital) at Horsham, which many of you may have seen, that is the principle adopted. The school hall is a great detached building, the chapel is a great detached building, and the school houses are themselves detached. One must ordinarily have a series of class-rooms opening from a corridor. If so, there should be class-rooms on one side only of the corridor, by which means they could, whenever there was an opportunity, open the doors and the windows of the room and the windows in the corridor, and so get a clean blow through. In plenum-ventilated schools children are unconsciously taught to go home and say, "Oh mother, you must not open that window" (in a room that was fœtid perhaps) "we never open a window at school." Such education given to a child is distinctly evil. I think also that where

you have plenum air, though it is very nice it is slightly enervating, and if it is too much filtered and too much moistened it becomes "soft"; whereas you want, if I may use the expression, to make boys virile by giving them brisk and fresh air. You should preferably, I think, heat the classrooms on the system of fresh-air-fed radiators under the windows, and then have aspirating flues to take away the foul air and dust, with ducts and fans at the top, opening the windows whenever possible. By this means you would educate children to love open windows and love open air, and I think that would be a very sanitary doctrine on which to bring them up.

Dr. G. H. Bailey (Owens College) said some years ago, purely as a matter of interest, he asked the School Boards of Manchester and Salford to set at his disposal half-a-dozen schools in Manchester and Salford, 3 in Manchester, 3 in Salford. They were to select the schools, and he simply asked that those schools should be selected as being typical schools, and after his investigation he was satisfied that they were typical schools. There were amongst them representatives of their best ventilated schools, at any rate those on which they, he presumed, had spent most money in the ventilation and were satisfied ought to be the best ventilated, and there were types of schools which were badly ventilated. In the course of those investigations he came across a great deal of stupidity, common stupidity of the most unpardonable kind, with regard to ventilation. He came across such things as immense cooking stoves with no ventilation whatever provided, forgetting the fact that every cubic foot of gas consumed is certainly as bad as the effect of the presence of one child and nearly as bad as the presence of one man. Under those circumstances the air of a class-room with a cooking stove (because some of these class-rooms were devoted to cooking alone) must be something dreadful, and the teachers even admitted that it was not possible to do anything in the room without having the windows, not only opened, but wide open. Then another thing he was struck with was this, that in some of the best ventilated schools, or rather those in which the greatest precautions had been taken, the air was still very bad, there being as much as 15 and 20 parts per ten thousand of carbonic acid gas. He inquired in that case into the ventilation, he saw that the whole apparatus was doing all that it could be expected to do and that it ought to be able to achieve a better result. But the conclusion that he had come to was this, in general, that the movements of air currents had not yet been sufficiently studied. It was true they could not colour them red, or colour them blue, but by making careful tests of the temperature and composition of the air they could recognise what the current of

incoming air and the current of outgoing air were actually doing and how far mixture was taking place. In connection with other investigations he had made experiments which convinced him that if they had a current of air at a moderate rate, and if the differences of temperature were rather considerable, the warm air and the cold air hardly mixed any more than oil and water. There seemed to be a sort of repulsion, and that fact he did not think was half enough recognised. Frequently in the case of these rooms air was coming in there, it was going out here, and they could trace it crossing, and absolutely the rest of the room was being unventilated. Now, of course, one solution would be to admit the air at a high velocity that would set up a vortex current and would bring about a mixing of the air. But they would say, to have air at high velocity was impossible, impracticable, 5 feet a second was the maximum rate which was admissible without draught. But then there was surely no reason why they should not make these rapid currents of air impinge on something which should distribute them and mix them with the rest of the room, and thereby indeed help the problem. Anyhow, certainly it seemed to him, from the little experience he had had, that the mixing of the air was a very important matter in any system of ventilation. He thought there was one point in which he could hardly agree with the speaker, when he gave them to understand that the quantity of carbonic acid gas within a short distance of the floor was somewhat similar to that near the ceiling. As a matter of fact he had made numbers of tests on that point and they might take it for granted that by far the worst air was always near the ceiling, that it went up in a sort of rising gradation. He had made tests at various heights and it had been established, he thought, several times.

Mr. Hall: Was that in a gas-lighted room, or a room without any gas-lights?

Dr. Bailey: That was in a gas-lighted room.

Mr. Hall: I agree with you. That is not my point. I am speaking of the day-time absolutely.

Dr. Bailey said he had made tests also without the gas-light in an ordinary room. His experience at any rate always was that the air near the ceiling was the worst air in the room. He was speaking of a closed room and not air that was pushed out by any means. As a matter of fact they could eliminate the idea of the heaviness of carbonic acid gas altogether, he thought, because what influenced the circulation and the movement of the air in a room was not the gases at all (the mixture of the gas which took place on diffusion and the currents of the gases) it was merely a matter of temperature. Heating and ventilation could hardly be separated, and in his opinion the only way to heat a building like a church, which was usually a building with massive walls, was to heat it over a prolonged period, keep fires in the place continually, and if they

once got the walls and the fabric of the church warm they would not be troubled by draughts.

Mr. J. Corbett (Salford) said he should like to call attention to two leading principles of ventilation. They could emit a draught from a tube or a channel and give it direction, and by judiciously multiplying and distributing air inlets they could carry streams of fresh air into every part of a building. But on the other hand they could not direct the suction. The air came from all points of a globe round the outlet equally. It did not matter whether the pipe was pointing upwards or downwards, there was the leading point. They could direct an inlet; but they could not direct an outlet. Therefore, some of the arguments that were often used about the fire being at a low level drawing air along the floor, or the opening being at a high level drawing air along the ceiling, were, to some extent, fallacious. It was a matter of common knowledge, and everybody seemed to acknowledge it, that if air was heated it would ascend. People were apt to forget that if they cooled air it would descend just in the same degree. He had a very telling instance of that some years ago, when he had occasion to visit a number of fever hospitals in winter time, where he found that beneath the windows (generally lofty windows in lofty rooms) there was a keen downdraught bringing the foul air from the ceiling by reason of the cold draught of the window. It was more perceptible there than anywhere else. As a remedy for that, they wanted hot-water pipes high up in the room to prevent the hot spent air from descending. It was the practice in Lancashire to heat loom-sheds by putting pipes aloft and none below because the lower space was valuable; and that had really a beneficial effect when combined with proper inlets and outlets. A point on that he should like to refer to, that in any room, however large, within reasonable limits, he thought it was always advisable to have only one outlet. If they had more than one outlet the odds were that one outlet would become an inlet and gave a cold shower bath of air coming down from the ceiling. As to the inlets he should say, make as many inlets as your limits of money will allow; let it be tempered air, only tempered, not by steam nor by red-hot surfaces, but of all things by hot water, and, if possible, do not draw directly through the walls, because then the inlets were subject to wind effects. The true principle, if they could adopt it, was to bring air in from more than one source or from a well isolated source. Sometimes in a building they could bring air from both sides into a chamber in the basement, which would draw to different parts of the building, and the wind blew through that chamber if it was blowing strongly from one side to the other. Another plan, also very efficient, supposing that they had open grounds near the place, was to have a shaft raised a little way above the ground. For instance, at the Salford Technical School they drew air downwards from a shaft in the public park some 40 yards, perhaps, away from the building, and the air passed through a channel underground and so to the ventilating fans and into the building. The wind had

absolutely no effect upon it. There again they had an outlet by a shaft with also a fan in it. They had both plenum and aspiration ventilation there.

A LADY MEMBER asked if the reason for putting the heating apparatus so high up in loom sheds in Lancashire was not so that the dust might be carried away from the works, as well as the smallness of the space lower down.

MR. CORBETT said he doubted whether the factory owners went in for such niceties as that. He believed the financial question was almost the sole consideration that ruled the construction of an ordinary loom shed. They wanted the whole floor space and therefore they raised the heating apparatus. They got accidentally very great advantages, but he doubted very much whether the ordinary factory owner or factory architect thought so much of the niceties.

DR. W. F. DEARDEN (Manchester) said he intended to confine himself to the particular branch of ventilation in which as a factory surgeon he was more immediately interested, that was to say, the ventilation of factories and workshops. Factories and workshops were practically the only places that had been really legislated for, as far as ventilation was concerned, and even those not to a very great extent. The ventilation which certainly had been worked out very well in factories was what one might call special ventilation. From the Factory Act of 1878, provision had been made for the carrying away of dust generated in various manufactures, and then in the Act of 1895 this was extended to the generation of gas in various processes. This legislation had undoubtedly a very educative effect, because when they were compelled to do something, people set their wits to work to devise means for attaining the particular end, and so the present state of the special ventilation of factories and workshops, or factories he might say, was of a very high order; in fact it was far ahead of any such suppositious method as putting hot-water pipes into the ceiling to take away dust or gases generated in the process of manufacture, mentioned by the previous speaker; he thought they had got a step beyond that. But he thought this educative method deserved to be imitated a little more in general ventilation. The provisions for general ventilation under the Factories Act were very short, with one notable exception, the Ventilation of Cotton Cloth Factories Act. That was the only Act of Parliament that fixed a standard of ventilation. It was a great pity that a standard of general ventilation could not be fixed for every public building; the working man in this country generally got the first consideration, and he certainly got it in this case. Possibly, many of them would know that the last Factory Act of 1901, based, of course, upon the experience of the Cotton Cloth Factories Act, decided to give the Home Secretary powers to make an order for factories and workshops generally. But unfortunately, up to the present that had never been utilised. The difficulty he wished to illustrate was this. Many of them would be aware that a Commission, or a Committee, had been appointed to make observations on ventilation of

factories and workshops and to make recommendations. That Committee had published a report, and that report had got plenty of good material in it and showed plenty of very excellent observations; but as far as the recommendations went, they seemed to him to be far short of what those who were perhaps qualified to judge on the matter thought should have been recommended. According to the recommendations, the Committee wished to fix a carbonic acid standard of ventilation, and this carbonic acid standard, instead of taking the standard that had acted so well in the Cotton Cloth Factories Act, 9 volumes in 10,000, was practically 13 volumes. That was a recommendation which did not appear to him to be in the right direction. Instead of lowering the standard to that extent one would have expected they would raise it. From the observations of the Chief Inspector of Factories upon the tests which had been made, it appeared that during daylight 65 per cent. showed a proportion of under 10 volumes per 10,000, but in spite of that they recommended 12 volumes per 10,000 as a limit, but no prosecution to take place unless 13 volumes per 10,000 be found. If there were 65 per cent. that came within the limit of 10 volumes per 10,000, surely if they wished to fix the new standard at 13 volumes they might just as well leave it alone, because he thought they would probably find that all the factories and all the workshops would pretty nearly come up to that standard. So that appeared to be legislation in vain. They went a little further as regarded gaslight. No standard had been made previously for gaslight, but they recommended a very low standard indeed under this head. They recommended 20 volumes per 10,000 as a standard, and then further that no prosecution should take place unless there was another volume ahead of that, that was 21 volumes for gaslight. Of course, any such order would have to be submitted to Parliament and possibly it would create a great deal of discussion. What had always satisfied legislators had been to fix the amount of cubic space. Fixing the amount of cubic space per head was no use whatever. But when they came to a standard of ventilation that was insisting on, say, a certain limited percentage of carbonic acid, or certain means for changing the air so many times per hour, then they got to something important indeed. If anything could be done to impress upon the Government the necessity of creating these standards of ventilation and at the same time the necessity of greater efficiency in the methods of ventilation, he thought they should be able to do some good. He should like to see the time when not only factories, but public halls, schools, churches, and everything of that kind should be compelled to have a standard of sufficient ventilation.

Dr. Howson Ray (Manchester) said for over four years he held the post of medical officer to the Salford School Board. Ventilation was probably the most pressing of all the problems a medical officer to a School Board had to face. He should like to say, first of all, that he had a strong feeling against the plenum system as applied to school buildings. He would admit frankly that his

experience was somewhat limited. It was limited to the examination of three schools. In a school ventilated by this plenum system he found (and he made these tests himself using the ordinary method of Pettenkofer) as much as twenty-two volumes of carbonic acid in rooms that were ventilated upon a plan somewhat similar in its superficial features to that in use in the room they were in. There were twenty-two volumes instead of, he should say, six volumes in the 10,000. He should add that outside that school the percentage of carbonic acid was rather higher than the London average or the general town average. It was as much as 5·1 volumes, therefore they were dealing with a somewhat vitiated state of the air, but still a rise from 5·1 to 22 showed that the advantages which were claimed for the system were, to say the least of it, extravagant. He had carried out actual experiments on the different strata of air, not right up at the ceiling, but at different levels. He found that in daylight the percentage of carbonic acid was higher the higher he went. Another point was this, as showing the importance of ventilation in their schools. The fullest use was made of all methods that were to hand, and he attributed very largely to that fact the result as regarded the non-closure of Board Schools in the Salford district. During the four years that he was medical officer only one school under the late School Board required closing on account of infectious disease. In the Salford Royal Hospital great use was made of what was known as the Boyd ventilating fire grate, and it was found most efficient. It was a fire grate with an air chamber drawing in air from different inlets, and then distributing it above the level of the fire-top, and finally this same air, or rather air mixed with it, passed out by a shaft parallel with and surrounding the smoke stack. That they found very efficient. He should like to read part of a schedule drawn up, on the ventilation of schools, for the use of teachers. It was a series of directions to the head teachers of schools.

The following instructions are to be carefully observed by the head teacher:—

1. The means of ventilation should be used.
2. Air inlets and foul-air outlets should be suitably opened, and kept free from rubbish and dust, and from being covered up by maps, blackboards, &c. A reasonable amount of draught is less harmful to health than is the breathing of impure air.
3. Windows should, where possible, be used to the fullest extent, and be so managed—by experimenting with the degree of opening—that a minimum of draught with a maximum of a change of air supply is attained.
4. Overcrowding in rooms and overcrowding in a class (placing the children too near to each other) should be avoided, as far as is consistent with fair administration of the class for teaching.
5. Where high winds prevail and windows are practically the only means of ventilation, those placed on the windward side of the room should be opened slightly at the top, and on the leeward side of the room they may be opened much more widely.
6. During playtime all doors and windows should be widely opened so as to flush the rooms with fresh air. At the dinner hour enough windows should be left open to attain the same object; and before the commencement of the morning school and at the end of the day's work, doors and windows should be left open sufficiently long to freshen the air of the room.

7. The school caretaker should have the doors and windows widely opened when sweeping the floors, and after washing the floors and furniture.
8. In cases where many instances of sickness (in its various forms) occur in one class of children the means of ventilation should be examined, and if found to be faulty a report should be sent to the clerk without delay.
9. All assistant teachers must carry out the above instructions, and so co-operate to obtain more efficient ventilation.
10. Some opportunity should be taken to explain to the children the need for fresh air, and to let them see this teaching put into practice.

Discretion must, of course be used in opening the windows before school in severe weather, as the opening of the windows at such times may prevent the school from getting properly warmed. In schools where any mechanical system of ventilation is provided, the head teachers should make themselves familiar with the system, and see that the instructions of the ventilating engineers are carried out.

Mr. H. E. Stelfox (Manchester) said the lecturer had spoken of applying heat to clerestory windows, but it was found in his own experience that the air was chilled by almost all the windows in churches, and currents of air were set up discomforting to the people who were sitting near. This chilling of air at the windows of churches was brought rather forcibly to his notice in connection with one of the schools of which he was the architect. After the school was opened and the work was going on a complaint came that there was a down draught from the roof extractor: this was in the central hall. He thought it was not very likely that that could be the case, and he went to make experiments. He found that the roof extractor was acting properly, and then he suggested that it was probably through the window side of the central hall facing north and having rather large windows, that the air was chilled and came down in a cold current on to the teacher who was sitting between two of the windows with her back to the wall. In order to remedy that, an extra radiator was put on either side of the teacher, and there had been no further complaints on that account. It was proved, he thought conclusively, that the cold current was caused by the descending air after being chilled at the windows. With regard to one point mentioned by the lecturer, the isolating of the central hall, he was afraid, although that might perhaps be done in certain schools of the grammar school type, it would be hardly possible or advisable in the elementary and other schools, at any rate of Manchester and Salford and this district, because it was found in the working of the school that it was of very great advantage to have the children passing from the corridors into the central hall and turning out of that central hall into the class rooms. He was very glad to hear that Mr. Hall did not advocate the plenum system in schools. He came there almost fearing that he should have to combat an order to immediately start putting the plenum system into schools. He was in agreement with the lecturer's remarks regarding the ventilation he recommended. He was supported in that by the fact that some two years ago he made a tour through Germany

inspecting the lunatic asylums there, which were now being instituted on the colony system. He found that the schools, generally speaking, were heated by means of low pressure hot water radiators, in many instances heated from a central heating station, the steam being conveyed to calorifiers and the water warmed and distributed on the low pressure system. On the other hand in most cases there was no extraction flue at all from any of the rooms. That seemed to him rather curious, and he spoke about it to the medical officer who was showing him round. He explained that they had gone very closely into the matter, and that they relied, and preferred to rely, entirely upon the open windows. The windows were kept very freely open and there was constant change of air by that means. He did not say that he recommended that, but the argument was that the more fresh air these people had the brisker they were and the healthier and the more cheerful.

Mr. J. D. Sutcliffe (Manchester) said that Mr. Hall's remarks had been full of useful hints and suggestions. The idea of sloping the ceilings of circles and balconies upwards towards the centre of the theatre instead of the now universal way of sloping them in the other direction was a valuable one from the health point of view, and he hoped the County Council and other authorities would adopt it. He thought good ventilation included more than a supply of fresh air and the extraction of vitiated air. The main point seemed to be the diffusion of the fresh air, and this was where ventilating engineers usually failed. For instance, in that very room it was plain to see from the ribbons fixed to the air inlet registers near the ceiling that a large amount of air was being blown into the room, and that the only outlets were at the fire-places at each end of the room. Now he felt sure that most of the fresh air coming in travelled in a very direct line to those outlets and that there was little diffusion. To obtain good diffusion required space and a plentiful supply of inlets and outlets, and he did not agree with Mr. Corbett when he stated that one outlet for the air in a room was as good as a large number. In dealing with drying rooms, where an even and fixed temperature was essential, he found that the more numerous the outlets the better the diffusion and distribution of the air and the more even the temperature. The old chemists called oxygen "vital air," but the chemists here seem to differ with each other as to the behaviour of carbonic acid in the air, and especially in its diffusion in a room. The late Professor Carnelly said: "The carbonic acid gas from the breath of a man standing upright does not diffuse until it is within two feet of the floor." He thought that statement generally correct, but it would require modifying according to the temperature and crowded state or otherwise of the room where the tests were taken. For instance, there must be an immense difference in the diffusion of the CO_2 in a weaving shed and a theatre. In a weaving shed the CO_2 has to be kept down to nine parts of carbonic gas in 10,000 parts of air, and each operative usually has 400 cubic feet of space for the diffusion of the 3,000 cubic feet of air per

hour supplied to him. In a theatre each occupant has frequently only about 25 cubic feet of space and if 3,000 cubic feet of air per hour were supplied to each person, this being the amount required to maintain the same standard of purity, the effects would be extremely disagreeable, and such as to put the question out of the range of practical ventilation.

Dr. Crowley (Bradford) said, first of all, with regard to the ventilation of hospitals and schools, the conditions were utterly and entirely different. In hospitals they had patients to whom they could easily give a large amount of cubic space, and there they were for the whole day and the whole night; and he knew of no method of ventilation of any use at all in a hospital other than what was called natural ventilation. The hospitals to which he belonged were ventilated in that way only. In one of them particularly, for which he was solely responsible, the windows were always open day and night, and the patients soon got accustomed to having the fresh air all round them. He ventured to think they could not apply that principle necessarily to schools. There they had conditions utterly different, they had a very large number of children in a comparatively small space for a comparatively small time. He had had the advantage of comparing mechanically ventilated schools with those which were not so ventilated. It was not practicable, as suggested by the lecturer, to have schools built in such a manner that each class-room opened into a corridor communicating with the outside and so ensuring a complete flushing of the room. Practically they had to have a central room with the class rooms opening out of it, and he had never yet seen a school which was properly ventilated by ordinary means. He admitted they could do a great deal more than was done to make them better, but they must begin by teaching hygiene to the teachers. Now with regard to the disadvantages of mechanical ventilation in schools, or rather let him take the advantages first. Dr. Kerr, his predecessor as Medical Superintendent of the Bradford School Board, showed in a report of his how much superior the mechanically ventilated schools were to those "naturally" ventilated. Undoubtedly one or two of the older schools mechanically ventilated were not altogether satisfactory, but given a decent caretaker, given a good superintendent of caretakers as they now had, they could get those worst schools into very good condition; the objections raised were nearly always objections which could be done away with by detailed care. In their latest school where they gave each child 1,800 or 2,000 cubic feet per hour (there was no juggling about that, it was a fact, they got it) the was air always pure and fresh, provided that the caretaker was doing his part. He knew there were drawbacks; but with regard to the disadvantages, considering that he was also a physician to a sanatorium and a lecturer on the prevention of consumption, he thought they would not accuse him of not believing in the use of fresh air, but they could not have everything. He admitted some force in the objection as to its being a bad education for the children to have the school windows

closed, but the system and the reasons for it could be simply explained to them, and they could be shown the trouble that was taken to supply them with pure air. He thought the plenum system had not reached its perfection, but the gentlemen who had spoken to some extent judged it by failures and not by successes. There was one thing which it appeared to him could be done with very great advantage, only there they must rely upon the common sense of their teachers in the mechanically ventilated schools. When the children were out they might if they wished, especially if they had a double duct system, as they had in their latest schools, have the windows wide open and get ordinary fresh air, and then when the children were all in again close the windows. A school mechanically ventilated and looked after with intelligence (and unless this could be secured he admitted the system would prove a failure) ensured a stream of pure air going through the school, and the result obtained would be found much superior to the ordinary method of ventilation of their schools.

Mr. A. M. Fowler (Manchester) said there was a very important practical remark made by Mr. Corbett, the truth of which came under his notice whilst in Leeds, when called upon to ventilate the cells of the Leeds Borough Gaol. There, there were several wings to a very large building, radiating like the leaves of a fan, and each cell was ventilated by means of hot air. They all knew that carbonic acid gas fell so soon as the room cooled, that was to say, the warm air assisted it in rising to the upper part of the room, but when the room was chilled it fell. Now the system adopted in the gaol at Leeds was to send in the warm air at the top of each cell and extract the vitiated air from the bottom. Every cell had two flues, one a warm air flue bringing in the warm air at the top, and the other the extract flue at the bottom. Those were taken up into the roof, gathered into a shaft and conducted to a tower. To prove the efficiency of that ventilation, which was thoroughly practical, he had several times gone up to see how this ventilation was working. He might say there was a door on each of these towers. He could not put his head into that door opening for the stench, and he had no doubt it was the carbonic acid gas which was drawn off. They had conveniences in the cells and they were the worst places possible to ventilate. Therefore, Mr. Corbett's illustration of the worst smells being close to the window where the warm air was chilled was confirmed; he would no doubt feel the carbonic acid gas, which was most deadly as they knew. With regard to the ventilation of workshops and driving off the dust, he thought they need not go very far to see a good illustration of that, at Mather and Platt's works at Salford. Mr. Mather looked after his workmen and took good care of them. They had everything that a master could give them, and one of the principal things which he did was to ventilate their workshops. They had an extract flue in each room which not only took dust but almost everything. They felt no draught whatever, but if they put anything near, within some yards of these extract flues, which were on

the floor, it was carried away ; they took shavings and everything bodily up into the roof right away, proving that the draught took everything possible out of the room. Natural ventilation was one of the most difficult things that they had in this country, to be applied safely. In summer time, when the atmosphere outside was perhaps at 80, there was no difficulty from the sunlight and the warmth outside, everything went out of the window. But when they came to the winter time, and had their warm comfortable room at, say, 70 degrees, and the atmosphere outside was at 32 degrees, perhaps below freezing point, they could not have the window or the ventilator open. Then the downdraught was felt passing into the warm room, and went up the chimney flue. Well, perhaps the remedy was worse than the disease in such a case as that, because whatever they might say with regard to fresh air, children, and grown-up people too, could not stand such fearful draughts as they sometimes got under such conditions. Now that electric lighting was so universal however, he might say it was quite a simple matter to have flues at the bottom by preference, and they could just hook off any of their connections and put in a small electric fan, and make an extract at once. It was artificial ventilation certainly, but if they had electric light in their house ventilation could be obtained at a cheap rate, and it was a thoroughly practical operation.

Mr. Preston (Lancaster) said, with regard to the pipes being fixed under the windows high up in a church or in similar places, he might say that point had been brought forward a good deal in the case of churches that had gas and now wished to have electric light. In many cases the congregation found considerable draughts on substituting electric light for gas. Of course naturally they came to the conclusion that it was a bad roof or there was some fault in the extract ventilators, but nearly always it was found that if hot water pipes were run along under the clerestory windows it considerably lessened or stopped the downdraught. Of course, it depended upon the form of roof whether it had much cooling surface, and the position of the windows. With reference to the remark made by Mr. Corbett as to one outlet in a room overcoming another; if there were two extracts in a similar position, or one perhaps slightly different from the other, sometimes one did overcome the other ; but he thought that in preference to having one extract in the room, if they had one common extract on the roof and two or three branch extracts in various parts of the room leading to that common extract, then there could be no reversal of the current.

Professor Radcliffe (Manchester) said they had before them the plans and sections of the air ducts throughout that large building, the Manchester Municipal School of Technology. They would understand that the ventilation of that mass of brickwork required a good deal of attention. The following statement had been circulated showing the capacity of the fans and the

methods of changing the air, and he could only add that they found it very efficient:—

> The air is drawn into the building through two large ducts (the height of the inlets above ground level may be varied from 25 feet to 70 feet) by two special 240 three-quarter housing pulley fans. The wheels of the fans are 12 feet diameter, composed of 10 blades, 5 feet 10 inches wide by 2 feet 6 inches deep, with a speed of 132 revolutions per minute, and with a clear inlet and outlet each fan will pass 200,000 cubic feet of air per minute. This quantity is sufficient to change the whole atmosphere of the building in 18 minutes or $3\frac{1}{3}$ times per hour. The air delivered would supply 8,000 people with 3,000 cubic feet each per hour. Each fan is driven by a 40 B.H.P. electric motor, with a speed of 665 revolutions per minute. Each motor takes 165 amperes at 220 volts. The air is washed immediately it enters the ducts, before it reaches the fans, Sturtevant wet filters being used for the purpose. The filters are formed of about 100 galvanised corrugated iron sheets 10 feet by 2 feet 3 inches, fixed on edge $\frac{3}{4}$ inch apart, completely filling the air inlet duct. Six very fine water sprayers are fixed above each filter, with a water pressure of 50 lbs. per square inch, each jet discharges 20 gallons per hour. The air and the spray pass between the corrugated sheets and deposit about 75 per cent. of the impurities in suspension on the corrugated surfaces. This is washed off by the water and carried to the drain. Immediately the air leaves the fans it is warmed to the required temperature by steam heaters. The heater consists of 10 sections of 4 rows, each 8 feet by 6 feet, and contain 1,060 feet of 1 inch steel pipe. The steam connections are arranged so that one or more sections may be used with live steam, or with the exhaust steam from the electric generating engines of the school. The air is conveyed to the rooms by the double duct system. One duct is used for warm air, the other for cold air. One or more mixing dampers are fixed in each room to be used as required, but the volume of air discharged through each opening is not varied except by the engineer in charge.

MR. HALL (London), in reply, said he had listened with great interest to Dr. Howson Ray's remarks with reference to the plenum system for the heating of schools, which he had himself tested, and also to Mr. Stelfox's remarks on the same subject. Now Dr. Crowley told them of his experience in Bradford. He hoped Dr. Crowley would forgive him, but he went over one of the very latest of the Bradford schools a very short time ago and it was plenum ventilated. He visited it with two or three other professional men, and they went into a class room out of which the children had just come. The first observation that one of his neighbours made was, "What a fearful smell!" It was the objectionable smell which they got in a badly ventilated room. They went into another room. He put his handkerchief against the inlet ventilating flue and it drew his handkerchief up against the grating; it was acting the wrong way. The school had been open about two months. The other objection he found to the system was that if they went into the flues, though there were most admirable screens, they would find the flue walls were covered with soft, black dust. He had seen that again and again in plenum flues. They would say, "You can always wash them." So they could, but it was expensive; they could not wash them every minute, and they were constantly getting foul. They could not in fact get rid of all the dust that came in, although they got rid of a lot, where they washed and screened the air. Dr. Crowley told them also that the best naturally ventilated school was worse than the worst of the plenum

ventilated schools. That might be because he was comparing a new plenum ventilated school with an old school where ventilation had not been studied at all. In most of the schools which were erected, until a few years ago the promoters never thought about such a thing as the study of ventilation. They put in windows but they did not think to direct currents, they did not think to warm currents, and of course they could not during lessons have a window opened letting in air at a temperature of 32 degrees. They must, in fact, study to do the ventilation scientifically, by whatever method they attempted to do it. The principle, as he understood it, of the ordinary plenum-heated room was that they forced air in, put the atmosphere of the room under pressure, and tried to press air out, either through the outlet duct or through the doors. Dr. Crowley told them that with the plenum system they had the advantage of teaching children that they must get fresh air in. What use was that to an ordinary child in life? They taught the child that he had to get it in by a fan. He could not do it in his house. It might be done in a factory where there were bodies of workmen, but there it was done by the authorities for the men. To teach a child that he had to depend on an artificial system of ventilation all his life was, he thought, dangerous teaching; they had better teach him that he had got to depend on fresh air, and that he should encourage the opening of windows. It seemed to him that what was learned by children at school was learned as much by visual observation as by aural reception. With reference to the question of the diffusion of CO_2, he believed chemists said the explanation was this, that the CO_2 which was respired from a person was something like 37 per cent. heavier than the natural air (perhaps they would correct him if he were wrong) but the volume of aqueous vapour which was given out was (he thought) 42 per cent. lighter. The gases appeared to agree to strike a balance between themselves, and the result was that practically the mixture became of the same density, the same specific gravity, as the ordinary air. That was apparently why they would find at different levels in an ordinary room almost the same amount of CO_2. His authority for that statement was Professor Haldane, who had made most careful and most detailed tests. He took a test at 2 feet, then he took a test at 4 feet, then a test at 8 feet, and a test within a foot of the ceiling, and the results were practically identical right through the series. This would not, as he said in his opening remarks, apply to a church. He thought what he had said answered the observation which Mr. Sutcliffe made, practically on the same subject.

DISCUSSION ON

ROAD SANITATION.

Opened by J. PATTEN BARBER, M.Inst.C.E.,
Borough Engineer and Surveyor, Islington,

And LOUIS C. PARKES, M.D., D.P.H.
(FELLOW),
Medical Officer of Health, Chelsea; Consulting Sanitary Adviser to H.M. Office of Works.

At Sessional Meeting, Wednesday, February 10th, 1904.

J. PATTEN BARBER:

IT is not with the view of being able to tell anything that is new respecting road sanitation that I responded to the invitation given to me by the Council of this Institute, but that I am anxious to do all I possibly can to assist in the discussion of this very important subject. In country districts it has hitherto been scarcely necessary to take into account sanitary construction in connection with road-making or maintenance, the only requirements being a sound, compact, and enduring surface, all which were met by a well-made macadamised road. But the increasing use of motor vehicles, especially of those travelling at great speed, will no doubt necessitate either the construction of dustless roads or the adoption of means for the prevention of dust being raised by vehicles from the ordinary macadamised roads. The first of these alternatives could be complied with by replacing the ordinary macadam with tar macadam, which, though a more costly material, is, when laid, freer from dust and mud than the most perfect macadam road can ever be; the second alternative would probably be provided for by treating the road with a material of an oily or tarry nature, as has been done with some success in various places during the past year. For town roads, especially those over which a great number of vehicles pass, sanitary requirements are, if not of prior, or equal importance to those of foothold and ease of traction, and assuredly should be placed no further away than next to them when

materials are under consideration. In the case of macadamised roads the question of the priority of sanitary considerations can hardly be disputed. When such roads are largely used by vehicles they are found to be incapable of resisting the effect of heavy traffic, whilst the large quantities of dust and mud produced by the combined effect of traffic and weather on the road coating have proved macadamised roads subjected to heavy traffic to be costly to keep in repair and in a cleanly state, and exceedingly difficult to maintain in a satisfactory condition for traffic, public health, or convenience.

Some few years ago I had under my charge a macadam road in Islington through which some 500 omnibuses were passing daily. The road was wide and everything possible done to keep the road clean and to prevent offensive smell from it; orderlies were employed and the road was washed thrice weekly and well drenched with deodorising liquids several times daily throughout the summer. But notwithstanding this work the smell from the road became abominable and unbearable. This case is mentioned to show that whatever care be taken it is impossible to keep a macadamised road exposed to great traffic in a sanitary condition, and that such material is altogether unsuitable for a busy thoroughfare. Unfortunately sanitary authorities, though recognising the necessity for replacing the insanitary macadamised road by some more substantial and sanitary pavement, have to consider, as the road authority, the question of cost, and unless it can be shown that a saving in the annual expenditure on the road will result from the abolition of macadam, there is a natural hesitancy to make the needful change in view of the spectre of the next election when those ratepayers whose ideal representative is one who keeps down or reduces the rates, condemn the man who considers the public health of greater importance than the mere saving of expenditure.

If, however, the health of the people is to be the first consideration, the macadam road under heavy traffic will be found to be the most costly form of construction, excluding of course such material as flint. The cost of keeping such a road in the same condition of repair and cleanliness as a paved road would greatly exceed the expenditure upon a road of the las mentioned character. A macadam road which it is necessary to coat so frequently as once in from two to three years should be converted into a paved road, for if all the advantages which would result from such a change were considered, it would be found that the expenditure on the work would be amply justified. There are many miles of these roads in the Metropolis from which large quantities of dust and mud are carried to the paved roads forming the main lines of traffic, so that if the necessary

paving were done it would benefit not only those residing in and passing along the macadam roads, but also the much greater number who are found in the busiest thoroughfares. The important work of reducing the quantity of dust in the atmosphere would also be greatly assisted by the paving of such macadam roads as need coating as frequently as I have stated. The road which would find favour with those who look only for one that is perfectly sanitary in construction might perhaps be described as formed of a smooth, hard, non-absorbent material, incapable of being indented or deformed by traffic, of being softened by any atmospheric temperature or disintegrated to any appreciable extent by weather or temperature, which could be laid in a homogeneous mass, without joints, and so placed and shaped as to admit of water easily flowing to the gullies. In selecting the material which would enable him to form this ideal road the engineer has not so great a number as to cause bewilderment. At present it seems there is but one which approaches the standard described, asphalt. Even this material has disadvantages which prevent the construction of a perfectly sanitary road, for as only compressed asphalt is suitable for vehicular traffic, it cannot be laid to that perfectly true shape which the ideal road should have, and the finished surface has innumerable depressions which, though of small depth, render it a little short of perfect. But the facility with which an asphalt road can be cleansed, the small amount of dust produced by its abrasion, its freedom from joints, and its non-absorptivity, seem to place it first as a material for sanitary road surfaces.

It is necessary to remind you that sanitary considerations only are under consideration, and the views expressed are not to be taken as applicable to the suitability of this material for giving a satisfactory foothold for horses shod as they are now. Wood pavements have the disadvantage of many joints and are absorbent, but the former can be greatly reduced by the use of bituminous grout for filling the joints, and the latter by creosoting the blocks under pressure or by the use of hard wood for paving. Hard wood, however, shrinks considerably in dry weather; the blocks then become loose and the joints enlarged. The insanitary conditions produced by these changes are easily discernible in the roads. I have never seen similar changes in creosoted deal, the reason being that the fibre of the blocks being compressed by traffic is bent over the joints and effectually seals them. A very accurately shaped road which is easily cleansed can be formed with wood blocks, but after a few years, the blocks, wearing away unequally, produce a surface not so easily kept clean as that of an asphalt road, which, owing to the greater and

more uniform homogeneity of the material, remains with a more even surface to the end of its life.

Granite sets, if the joints be filled with bituminous grout, make a practically non-absorbent road, but noisy and not so easily cleansed as the other paving materials mentioned. It appears that the authorities in large towns are prevented from adopting the material which would make the most sanitary road surface for the principal thoroughfares by the consideration which must be given to the necessity for providing a road which will afford a good foothold for horses. It is worthy of consideration, however, whether it is not possible for a mode of shoeing to be devised which would relieve the authorities from thus having to subordinate the health and convenience of the people to other claims.

But the most perfectly sanitary road construction is of little use unless attended by an equally perfect system of cleansing. The most suitable material for the road having been laid with the greatest care and skill is at once the receptacle for dirt and filth from various sources. The greater part of the dust and filth in the principal streets is no doubt contributed by horses, and this is less objectionable in wet weather, but in dry weather, after having been ground into fine dust by the traffic, it passes into the air and becomes part of the town's atmosphere. The time is not near when horse traction will be superseded by motors, or it might be stated that the chief source of road pollution was soon to be stopped. It is therefore necessary that the arrangements for producing and maintaining sanitary roads should deal with conditions as they are, and that whilst lamenting the amount of preventable dirt which is found in the streets, and taking all available measures for stopping it at its source, the best available means should be adopted for promptly clearing away everything in the shape of dust, refuse, and filth from the streets. A well-organised system of orderlies for removing filth and refuse during the day, and a thorough washing by hose or water-vans and machine brooms daily, is the least that can be done to busy streets, unless they have been sufficiently washed by rain, or the lowness of the air temperature renders washing dangerous.

A plentiful and cheap supply of water is an absolute necessity for the thorough cleansing of the principal thoroughfares; and a sufficient staff of intelligent workmen, who are active, alert, and capable of exercising judgment in the execution of the work, instead of the ignorant labour with which those responsible for street cleansing are too frequently handicapped, and yet are expected to produce results which are only possible with intelligent and active workmen. The freeing of a road from semi-

liquid mud or slop is a simple operation, but the removal during the daytime, from a road crowded with traffic, of the thin film of greasy material which causes horses to slip in a manner too well-known, is a most difficult, if not an impossible task. Owing to the extreme thinness of the material to be removed, it is unaffected by any tool that can be applied to it, whilst any attempt to wash it away by first watering the road and converting the greasy substance into slop, might unduly interfere with the traffic, and would certainly be much complained of by pedestrians: although a shower of rain, which would have the same effect as the watering, being a natural occurrence would evoke no comment. Limited as he must needs be by a regard for public opinion and convenience, the borough engineer has but one remedy available for a road in the condition referred to, viz., to make a temporary surface by a plentiful sprinkling of sand or fine shingle, and to thoroughly wash the road at night. The removal from the roads of the mud and slop which are produced in unlimited quantities in wet weather, is never, one may safely say, carried out in a manner which satisfies the public. But these requirements are frequently as reasonable as the estimates of the depth of mud on the roads, which is always either ankle- or knee-deep. The work can be done in a reasonably efficient manner, and well enough to satisfy any reasonable critic, if a sufficiently numerous staff and the necessary amount of supervision be provided; this, however, cannot be done without considerable expense. The public too often imagine that the roads can be cleansed much more frequently without the employment of more men or an increased expenditure. The whole difficulty of satisfactory cleansing is one of expense. It involves the supply of a proper number of men, sufficient plant and equipment, and adequate supervision. The engineer *can* keep the roads in a satisfactory state of cleanliness, but he cannot do it unless he is provided with the means. The evils wrought by under-manning, lack of equipment, insufficient direction, control, and supervision, are feared and condemned in every department of business and public service, except in that service which has to maintain the public roads in a proper state of cleanliness. Therefore, when the public makes its complaints about the dirty condition of our streets, it is hoped it will remember that sanitary authorities can give improved conditions, provided the public on the one hand is willing to pay for what it asks, and the authorities on the other are willing to expend the money for employing the necessary men and staff to carry out the work.

Notwithstanding the washing and thorough cleansing of the streets in the busiest parts of the Metropolis, and the staff of orderlies engaged in

gathering up the filth during the day, dust is produced in large quantities in dry weather, and dispersed so widely that the air is laden with a mixture of finely powdered manure and other débris from the streets. Indoors the presence of this material is made apparent by its deposition on every surface, out of doors by the suffering produced in eyes, nose, and throat of those exposed to its action. The insanitary and offensive atmosphere produced by this dust tells more severely on persons whose visits to the crowded streets are but occasional, and who live away from the impurities which are here met with; possibly those in daily contact with it are less conscious of its effects, but the nature of the material is obviously so noxious that it cannot be regarded as non-injurious to them. The prevention of dust is without doubt of great importance in every locality, but in a crowded city where, despite all precautions, impurities are largely produced by the countless operations carried on, every care is necessary to render the air as free as possible from solid impurities such as are given off from the streets. The patrolling of the streets during hot dry weather by vehicles, containing water to which a disinfectant has been added, specially adapted for distributing the contents in a fine spray, would probably prevent much of the dust which now causes nuisance; at least it seems worth a trial. Possibly, as the development of motor vehicles advances, a machine may be constructed which, while passing along the street, may, by exhaustion, carry up through a duct, whose lower end travels over the road surface, the dust and dry refuse, and discharge it into a suitable receptacle containing water.

In the outlying districts it is possible to keep down the dust provided a sufficient staff and a sufficiently numerous equipment is provided, but there are certain days when with a high wind and a high temperature ten times the ordinary staff would be needed to keep down the dust which is raised. However, during the last twelve months experiments have been made with a material from which I am hoping very satisfactory results will be obtained, the mixture with the water of a material which it is believed will have the effect of keeping down the dust which would otherwise be raised by the passing traffic.

Another source of impurity in our streets is the too frequent use that is made of them as a dumping ground by the costermonger and itinerant vendor, and by the shopkeeper who sweeps the refuse from his shop into the street, which he seems to regard as a suitable receptacle for the refuse from shops and premises abutting upon it. That is one of the preventable sources of filth and refuse in our streets, and one, I think, which should be dealt with very severely, in order that it may be put down. In that

way much may be done to bring about a better state of cleanliness in the streets of the metropolis, which is undoubtedly very much needed.

DR. LOUIS C. PARKES.

THE insanitary condition of the London streets has previously been the subject of discussion at one of our sessional meetings, and there is probably but little that is new to be said on this well-worn theme. The Council of the Institute, however, in its wisdom has thought it appropriate to have yet another debate on the subject, chiefly I presume because it realises that very little has as yet been done to inaugurate that era of street cleanliness in the metropolis which is our desideratum, but of which the attainment appears to be so difficult.

Now firstly as to the health aspects of this question. It may be asked, Is the condition of our streets dangerous or injurious to health? And if so, what are the exact conditions that are dangerous or injurious, and how do they operate? To these questions it may be said at once that there is very little direct evidence that any injury to health is caused by the insanitary condition of London streets, chiefly because out of the multiplicity of conditions favouring or exciting loss of health or actual disease amongst our population it is most difficult, if not impossible, to select a certain agent where so many participate, and to say definitely this is the exciting cause. On the other hand, with the continual advances made in Pathology and in Bacteriology, we are enabled, as time advances, with more and more certainty to select *a priori* certain conditions as being those which from analogy we should consider to be capable of influencing the public health, and although no complete proof is capable of demonstration, we are satisfied to regard these conditions as operative factors.

Bearing in mind then the above limitations, we may say at once that there appear to be two things intimately associated with our London streets that we may reasonably regard *a priori* as influencing adversely the public health. They are dust and mud, different names for essentially the same thing, for whilst dust is dried and powdered mud, mud is merely wetted dust. People say, where does all the mud in the London streets come from? The answer is that 1 lb. of dried dust, containing 30 per cent. of moisture (water), when wetted to contain 90 per cent. of moisture will weigh 7 lbs.; so that, the volume being roughly proportional to the weight, a cubic foot of dry road dust, after rain has fallen, becomes 7 cubic feet of semi-liquid mud. The municipal authorities, who prior to

the rain had only 1 cubic foot of dry dust to remove, after the rain find themselves called upon to remove 7 cubic feet of mud. Hence the enormous economy of keeping the streets as clean as possible when dry, and so avoiding the collection and removal of countless tons of slop.

Now, as we all know, the mud and dust of London streets, especially in the great highways of traffic, is filth; it is largely composed of putrefying organic matter from horse-droppings, with its teeming swarms of putrefactive bacteria. Which is the most dangerous to health, mud or dust? To this we can safely answer, dust. Why? Well, dust attacks our mucous membranes, *i.e.*, the delicate lining membranes of the orifices and passages leading to our internal organs. Mud does not; that is to say, unless the passer-by happens to have a lump of mud splashed into his eye or mouth. Then again, the dry dust of the street not only gets into our nostrils, throats, and possibly into our lungs, but it finds its way into our houses, and, unless we are careful, settles on our food, and by its contained bacteria sets up fermentative changes therein, which render it at times unwholesome, at other times positively dangerous. The irritating decomposing dust of the London main thoroughfares has been credited with causing sore throats (follicular tonsilitis), nasal catarrh, conjunctivitis, pneumonia, and numerous other diseases of the respiratory organs and passages; and it seems at least highly probable that this organic dust, which is so much in evidence in the London streets in such months as March when the wind is dry and boisterous, and which taints the whole atmosphere in the warmer months of the year when rainfall is deficient, is a contributory if not the exciting cause of these and other diseases.

The past year, 1903, supplied an experimental demonstration of the way in which relative absence of dust may conduce to a healthy season and a low death-rate. Last year was one of the healthiest years on record in London, and it was one of the wettest. The general death-rate was only 15·7 per 1,000 per annum, which is 2·8 per 1,000 below the average of the previous five years, whilst the rain fell almost continuously and persistently throughout the spring and summer, especially in the months which are usually the driest and most dusty, reaching a record for the year of 38 inches (Brixton), or 56 per cent. in excess of the average. The consequence of the continual downpours was that the streets were kept flushed and cleansed, accumulations of dust were washed away, and the general atmosphere of London was distinctly purer than is its wont.

From an interesting note in the *British Medical Journal* of January 16th I may quote the following: "One feature of the rainfall of 1903 in

London was the excessive weight of many of the individual falls, or their intensity rather than their duration; for, although the excess was (at Brixton) nearly 6 inches beyond the fall in 1879—hitherto the wettest of the previous thirty-five years—yet the number of days with rain in 1903 was smaller than in six of the past thirty-one years. In the thirty years ending 1900, the number of days with rain was on the average 166, and the average rainfall on each rainy day was 0·147 inches. Last year there were 171 days with rain, and the average fall on each of these days was 0·202 inches, or nearly half as much again as the average. Exceptionally heavy falls of rain (exceeding one inch in twenty-four hours) were nearly seven times as numerous as the average; heavy falls (exceeding half an inch) were nearly twice as numerous; and moderately heavy falls (exceeding a quarter of an inch) were more than half as frequent again as the normal. In London the highest rainfall was that recorded at the Victoria and Albert Museum, Kensington, 42·37 inches; the lowest that at East Ham, 32·29 inches. The exceptionally wet months of the year were June, July, August, and October. February, November, and December were less wet than usual. In June three times the usual volume of rain for the whole month fell in ten days."

In 1903, then, nature very materially supplemented the usual cleansing operations of the London municipalities, with the result that during the wet periods the roads presented a wonderfully clean appearance, and the private drains and public sewers received such a flushing as they have seldom received before. All this was most beneficial for the inhabitants of London, except perhaps for the unfortunate people whose basements were flooded by the storm waters which the sewers were inadequate to convey away.

The lesson of 1903 would appear, then, to be that greater attention should be given to the flushing of our main thoroughfares with water, especially in the warm and dry months of the year. This is especially important in the case of asphalt and wood-paved roadways. On such surfaces the dirt consists of little but horse droppings, which very quickly desiccate, and form a strong and pungent dust, easily raised by the wind. All wood and asphalt streets which are main lines of traffic should be flushed with hose and jet, and subsequently swept, every morning from March to October, unless there has been heavy rain in the night. It is very commonly the practice to sweep the streets when dry, but this is a practice not to be commended, as the operation raises clouds of dust, which settle again, often out of reach of the broom, and the result is not satisfactory. In very busy thoroughfares, where there is much omnibus traffic,

I think that some disinfectant solution should be mixed with the water in the watering carts, not necessarily to disinfect, but to deodorize the dirty wood roadways, and to at least attenuate the odours about which so much complaint is made. Possibly a chlorinated solution, containing a small amount of available chlorine, would be the best for this purpose. If one gallon of "Chloros" (a solution of sodium hypochlorite containing 10 per cent. of available chlorine) is mixed with 1,000 gallons of water for street-watering, a dilute solution containing 0·01 per cent. of available chlorine is obtained. This is probably of strength sufficient to act as a deodorant in the case of wood-paved roads.

Extra flushing and cleansing of the streets means extra cost. There is no available supply of cheap, unfiltered water in London, and nothing has yet been done to draw a supply of water for flushing purposes direct from the Thames in London. The rates are already very high. Is it possible to go to greater expense in this matter? I find that in 1902 in Chelsea the cost of cleansing and scavenging the streets, including watering, was about £14,000. The maintenance and repairs of the public roads, streets, and paths cost another £14,000. Assuming that the whole metropolis spent a proportional amount in accordance with its population, an assumption which probably errs on the side of being under the mark, as Chelsea is a little off the main traffic routes, then the annual cost of scavenging, cleansing, and watering the London streets is about £850,000, and a similar sum is spent annually in maintenance and repair.

If motor-traffic could be made to supersede horse-traction in London it seems probable that the cost of scavenging, cleansing, and watering could be reduced by half, and the cost of maintenance and repairs by a similar amount, a total saving of £850,000 per annum. It is the horses that produce the dust, dirt, and mud, that has to be laboriously collected by hand-labour and carted to the outskirts, or barged away down the Thames. It is the horses' iron-shod feet that tear up the roadways, and render necessary the enormous annual expenditure in maintenance and repair of the streets, and their periodical renewing at short intervals. If there were no horses the slop-water from asphalt and wood-paved streets could be swept straight into the gullies and so to the sewers, and the wear and tear of the street-surfaces would be enormously reduced.

Motor-traffic, then, is a thing that the intelligent Londoner should encourage by every means in his power. It is the only real and lasting solution of the "insanitary street" problem. Enormous additional sums under existing circumstances might be spent in scavenging, cleansing, and watering, but the total result would not be very appreciable in a dry and

hot season. We cannot expect natural causes to aid us every year, as the weather did in 1903, nor is it otherwise a consummation to be wished for.

Probably the best means of accelerating the transition from horse-traction to motor-traction would be (1) the widening of the main lines of traffic, so that vehicles could proceed at a uniformly greater speed than at present. Carriers of goods and passengers in the streets of London will not adopt motor-traction unless it will pay; and motor-traction can only be remunerative if the increased initial cost of the motor vehicle over horse and carriage, and the higher rate of remuneration required for a motor-driver as compared with a horse-driver, are counterbalanced by the ability to make the motor-driven carriage do a proportionately larger amount of work in the same time. This necessarily involves rapid transit and quick journeys, which are only possible if blocks and delays are comparative rarities and not the every-day occurrences they now are. (2) Inasmuch as it is especially desirable that heavy two-horsed vehicles such as omnibuses and drays should be replaced by motor-driven vehicles, as it is essentially the heavy horses and heavy loads that, continually stopping and re-starting, tend to break up the surface of the streets, it would seem desirable that omnibus companies and companies or firms carrying heavy goods should be encouraged to inaugurate motor-traction by a system of municipal subsidies. If over a million and a half sterling is spent annually in London by the ratepayers in scavenging, cleansing, and repairs of the streets, necessitated chiefly by the employment of horses for all classes of traffic, £100,000 annually might be devoted to a system of subsidies, by the aid of which a portion at least of the heavy horse-traffic might be got rid of from the streets, and the cost of cleansing, scavenging, and repairs materially reduced. A beginning once made in this direction, the advantages of motor-traction would soon be generally recognised, and in the course of a few years we might expect to see at least as many motor-vehicles as horse vehicles in the streets.

So far, this short introduction to a discussion has been chiefly in relation to the sins of the horse, the noble quadruped that has so many sins and shortcomings laid on his shoulders. But I cannot conclude without a few words about dogs, man's four-footed companion. In my opinion dogs in London are an unmitigated nuisance. The disgusting condition of the pavements and sidewalks in many parts of London is due to dogs' excreta. Some years ago there were men who made a business of collecting dogs' excreta in the streets and selling it to the tanneries, where it was used in water as a solvent for hides preparatory to tanning. Now I suppose dogs' excreta, or its chemical equivalent, is made in

Germany by a chemical process, and can be put on the market cheaper than the street collector of this choice product can supply it to the tanneries. However that may be, it seems to be nobody's business now to collect the refuse, and even the municipal road sweeper passes it by. There used some years ago, prior to 1891, to be a Police ordinance that householders should clean the footways adjoining their premises. The Public Health London Act abolished all that, and placed the duty of cleaning the footways upon the local authorities. But according to my observation the men employed by the local authorities seldom concern themselves about the sidewalks, and unless the householder cleans the pavement in front of his own house, nobody else troubles to do it. To clean the pavement properly, water is required, but as a rule none is available from a public source; so that to make the local authorities responsible for work, which they have not got the means of properly executing, seems to be an absurdity.

It certainly seems desirable that our borough surveyors should seriously consider as to the best means of cleansing the footways, and so performing a duty which the State has cast upon them. In order also to keep the dog nuisance within bounds, I would suggest that the London County Council apply for Parliamentary powers to put a municipal tax upon dogs in addition to the Imperial tax. A municipal tax of ten shillings per annum per dog would tend to make many dog owners reflect that dogs are not indispensable adjuncts to life in this great city, and the general public would at least feel that those who create the nuisance are to some extent called upon to support the measures necessary for its abatement.

To sum up, then, our conclusions in one sentence. All animals in big towns, except of course man himself, are a nuisance. Let us do our best to get rid of them.

Mr. W. Whitaker, F.R.S. (Croydon) said he was glad that Dr. Parkes had alluded to the wet season of 1903. Everyone thought it was a very bad year. For his part he did not. If there was one thing to which he objected it was dust, and last year was very free from it. He preferred a little rain to a great deal of dust. Now this object-lesson of last year had shown the advantage to the public health of laying the dust; he hoped it would not be forgotten by the local authorities. That lesson had been given without charge, and therefore he was afraid they perhaps might not value it as they should do. No doubt infantile mortality had been reduced because the children last year could not play so much in dusty streets. Undoubtedly it was in the power of our large Corporations to modify the dust-nuisance, or at all events to convert it into a

form that could be easily removed. They all knew what a trouble dust was to the female mind; ladies would go on dusting in the home, but it should be done with damp cloths. To deal with the different degrees of blinding dust in our streets was one of the most important problems that municipalities could devote their minds to. No doubt it would cost something, but we cannot have benefits without paying for them. Indeed we should not object to pay for those conveniences, without which in big cities the people could not live comfortably or healthily. The question was one between paying a certain amount of rates and having a large increase in the death-rate, especially among the younger members of the community, and the gentlemen who had addressed the meeting had properly dealt with every aspect of the problem.

MR. SHIRLEY MURPHY (London) said there were only two points he wished to raise. The first was that the condition that was wanted in the roads of every town was that the surface should be impervious, washed and cleansed. He was told by surveyors in London that the reason we could not have these conditions was a question of cost. Now he had not even seen it stated (and it would be well worth while working out) how much would be saved in the cost of cleansing if a large area of a town were paved with impervious material and washed, as against the cheaper cost of macadam, with the additional cost of scraping up the mud and the removal of the large quantities that collect upon its surface. Probably the balance would be on the side of the greater expense for the impervious material. He did not think the difference would be so great that the inhabitants of a town would not be in favour of the greater expense and the better conditions. Of course, it would be necessary that the area so to be dealt with should be sufficiently large, because now we had the main streets paved with impervious material, but the side streets were macadamised. The mud and dust from the macadamised streets was carried to impervious surfaces of the other streets, and the saving that ought to be effected from the better paving was not now obtainable. If in London they could not have the whole area dealt with by one uniform paving, it would be very desirable that there should be some general agreement between the authorities of the different districts of London as to how the main and important roads should be paved. He had discussed this matter with borough surveyors who had said that with varying local conditions and requirements it is impossible to have anything like a uniform pavement over so large an area as London. There might be a good deal of truth in that, but he had noticed in some cases where a road passed through two different boroughs and where the traffic conditions are identical yet different pavements are used. Making due allowance for difference of opinion as to what is the best thing to be done, that was a difficulty which it ought to be possible to overcome. There ought to be enough experience now to determine how all main roads should be dealt with how all secondary roads should be dealt with, and how the minor streets and courts and alleys should be treated. The necessity for dealing with the poorer

streets, especially market-streets, with some impervious pavement was obvious. Animal and vegetable refuse collected there very easily, and without frequent scavenging at considerable cost became a definite nuisance.

Mr. J. P. Waddington (Borough Surveyor of Marylebone) said the main question appeared to him to be one of money. Speaking for his own district, the great difficulty he had to meet was how to get his authority to give him sufficient money to do the work thoroughly. When the estimates for the year were being framed the tendency always was to cut them down, not to give the department any more money for doing the work more efficiently. As to the suggestion to construct suburban roads with tar macadam, he had had some experience of this in the North of England, where he had constructed $3\frac{1}{2}$ miles of this form of carriage-way for a main road between two large towns. Having regard to the cost it wore extremely well, and was certainly more sanitary than an ordinary limestone macadam road. The road was made up of limestone dipped in tar. There was much less dust after the tar macadam was laid. The question of paving for London roads was a very wide one, and one upon which very different opinions are held. Speaking personally, he should be sorry to see all the carriage-ways in London asphalted. He admitted, however, that up to the present time asphalt was by far the most sanitary and easily cleansed material, but it was very cruel for horses, and at times dangerous for riders. Some forms of hard wood paving were also very slippery. For instance, the carriage-way in Oxford Street, by the Marble Arch, was paved with Australian wood and had been down about $4\frac{1}{2}$ years, but the complaints had been very numerous, several accidents had happened through horses slipping when the wood was slightly greasy. But soft wood paving was luxurious and in his opinion worth the money laid out upon it. Now Harley Street, an important thoroughfare, was paved with yellow deal treated with carbolineum. The blocks were immersed in the liquid for some 4 or 5 minutes, allowed to drip, and then laid. He had noticed that during dry weather there was less dust on the carriage-way in Harley Street than was the case in streets immediately adjoining, which were paved with wood coated with liquid tar or cresoting material. But after rain the surface of the road in Harley Street appeared to dry sooner than in the other case. He believed a similar experience had been gained in the City of Westminster. While he thought, therefore, there was a good deal to be said in favour of this material, he was not in agreement with the mode of applying it. He thought it ought to have a longer immersion. The Marylebone Vestry paved a portion of Albany Street, alongside Trinity Church, with deal immersed for 30 minutes, and that was the best bit of deal paving in the metropolis. Owing to readjustment of boundaries that strip was not now in his borough, but while it was under his control, a period of about five years, he did not remember having to effect any repairs, no bad blocks showed up in the whole of the surface, and the same effects were noticeable here as in Harley Street. It seemed to dry

much sooner than the adjoining paving and there was less dust upon its surface in dry weather. He did not agree with Dr. Parkes' suggestion as to the abolition of horses and dogs. Personally he was a lover of animals and he hoped the day was far distant when they would see no dogs or horses in the streets. He would much prefer to have the animals and pay a little more in rates to keep the streets clean. As to washing with water from a hose, now done in several parts of London, he believed this was injurious to both soft and hard wood paving, because the water gets into the interstices, washes out the grout, and the blocks begin to loosen. He preferred the old-fashioned method of washing by a water cart. Before the formation of the City of Westminster, Marylebone had more wood paving than any other district in London, and these roads were washed by means of water carts and squegees. Machine brooms were tried for one or two years, but he had found the work could be done more efficiently and economically by hand labour. Unsatisfactory wood roads he believed were often caused by washing with hose pipes, and therefore his experience suggested the old-fashioned method was the best.

Mr. C. H. W. Biggs (London) confessed to some cynicism in regard to the treatment of this subject by the local authorities. The two papers were a disgrace, not to the gentlemen who had read them, but a disgrace to England, to sanitarians, and to civilization. Here was an expert getting up and saying that we could have sanitary streets if someone would only pay the cost, and this at the beginning of the 20th century. He thought the public did not lose their tempers often enough. We know better than to keep our streets in this state, yet were content to breathe the dust every summer's day. If they could teach the people that this extra expenditure would pay them, then the money would be forthcoming. Would better streets pay the public? Yes, because it was a distinct money value to have men healthy during their working lives. That money value would be found to be more than the extra cost of keeping the streets sanitary and clean. Drive that into the heads of the public and the money would be supplied. This question had been discussed for the last 25 years and the cry was always the same, that the people would not give the money, not for stronger and longer lives, not for means for doing more and better work. If anything could be said that night that would induce people to regard this question differently then a great general benefit would be conferred on the community. With regard to macadam, they would find it impossible to make macadam-streets to wear satisfactorily with heavy traffic; and they could not be kept sanitary. Then the logic of the case was that they should be done away with in such places as London. Tarred macadam was a better material everyone knew, but we do not use it, or if we do use it at all we do not use it to the best advantage. In places like Cromer and Harrogate many miles of roads of this construction would be found bearing a fairly heavy traffic. It wears well and is sanitary. He had long ago advocated motor-traffic, because by its introduction

we should get perfect street surfaces, the contact between the wheels of a motor vehicle would be altogether different in character from the ramming and scraping contact of horses' hoofs. The streets would last longer and the cost would be less. Slipperiness on good surfaced roads had been referred to, and he was of opinion there were two people to deal with this evil, the maker of the streets and the shoer of horses. If the shoesmith will put upon horses the very worst possible form of shoe, then although the maker of the street might be doing his duty the shoesmith was not. If horses were properly shod it would be impossible for them to slip. People who drive valuable horses ought to insist upon their being shod properly. He thought it was disgraceful that at this period of our civilization it should be necessary to have two such papers as those read that evening in order to drum it into the heads of the people to pay money and pay it quickly.

Mr. T. Langston (Marylebone), as a maker of roads, bore testimony to the dust and mud-producing qualities of the macadam road. It stood to reason that hard wood must be more slippery than soft wood, and it must also be more noisy. At Nottingham tar-macadam was used in nearly all the streets, and the result was that that city had splendid roads, which stood a great deal of wear, as was proved where it was used on the road to and from the Trent Bridge. Personally he was in favour of asphalt, especially for the coming motor traffic, and there was no reason why it should not be all asphalt in London, fine sand or powdered shell correcting the tendency to slipperiness. Horses were at present shod wrongly, and they could be shod to meet the requirements of asphalt streets, which were sanitary and clean.

The Chairman (The Rt. Hon. Lord Monkswell) said that it had given him a great deal of pleasure to be present that evening and to hear the interesting discussion which had taken place. To a great extent he sympathised with Mr. Waddington, who deprecated the suggestion that horses and dogs should be made to disappear from our streets in this great metropolis. Was it to be also suggested that every other animal, including the birds, should follow suit? Then cats had also to be taken into consideration. He had listened with interest to the rather fierce lecture of Mr. Biggs on what might be called the pig-headedness of the public. Someone had referred to the spectre of the "next municipal election." Well, that spectre was before him, and perhaps Mr. Biggs would understand that consequently it was difficult for him to speak his mind, even if he were in entire agreement with what had been advanced in the denouncement of the human race in general. Now, the medical profession was always making wonderful discoveries, and Dr. Parkes had made two discoveries that seemed to be rather remarkable. Last year there were two things that the average Briton used very bad language over, one was the rain and the other was motor-cars. In regard to motor-cars he had his own special grievance, inasmuch

as he was nearly killed in the early autumn in a motor-car accident. He was not therefore quite prepared to give the motor-car that enormous subsidy suggested by Dr. Parkes. The medical profession, however, had discovered in the two things, rain and motor-cars, the greatest possible benefactors to the human race. He might express his general concurrence with the views that had been put forward that evening, viz., that in all probability a considerable increase of expenditure is desirable in the cleansing of the roads and streets. That was not, however, the only direction in which increased expenditure might be desirable.

Mr. J. Patten Barber (Islington), in reply, said it was true that year after year they preached the same sermon, and perhaps the whole matter was one which time alone would settle. As his lordship had suggested, education was required. When those who took a broad-minded view, as many did, wanted a better state of things, roads kept in better repair, macadam and other insanitary materials abolished, the dust kept down, refuse kept out of the streets, these reforms would come. Public wants were increasing, and rightly so, but he was afraid general intelligence was not increasing, because there were many persons who were unable to see that they could not get these things at the same cost as the things with which they now had to be content. Half a moment's consideration should convince anyone that if scavenging was to be done three or four times instead of once a great deal more money must be spent. A man must admit that if he wants double what he now has he must pay something like double the cost. This was a matter of education. Happily there were men who were absolutely fearless in spending money on right objects, and who were not afraid of the pains and penalties with which they were threatened when next they asked for the votes of the electors. To his mind there was too great a cry made of reduced rates and reduced expenditure by those who knew it was impossible to obtain these reductions, and why that cry was always raised when elections were approaching he did not understand. Those who had studied London problems must know that the expenditure on all matters relating to public health and convenience in this great city must of necessity increase as the population increased, the amount of traffic increased, and the wear and tear on the roads increased.

Dr. L. Parkes (Chelsea), in reply, said it seemed to him there might be a little more efficiency in the work done now. The idea still prevailed among some London municipalities that any class of man was good enough for cleansing the London streets. That was not so. It really paid better to have young and intelligent men to do even work of that sort. Care and intelligence was required to do the work properly, and it paid to have it so done. Cheap labour was a great mistake in most things, and he was sure it was so in municipal sanitation.

DISCUSSION ON

MUNICIPAL REHOUSING.

Opened by W. E. RILEY, F.R.I.B.A.,

Superintending Architect of Metropolitan Buildings, and Architect to the London County Council.

At Sessional Meeting, March 26th, 1904.

ALTHOUGH I am in no way responsible for the subject for the discussion I am honoured in opening to-day, I cannot complain of its want of fertility.

Municipal rehousing is a subject which engages the earnest thoughts of many men, and, as an important part of the broader question of housing the poor, has received on numerous occasions the most sympathetic consideration of H.M. the King and all the leaders of both Church and State. It demands close scrutiny and helpful criticism, so that those, who like myself, are trying to give effective practical assistance in doing the work of this branch of the question, will, I am sure, readily record their appreciation of the selection of the subject. I approach the duty of opening the discussion with diffidence, and the most insistent difficulty is the inability to cover the ground without leaving out essentials, and so divert the consideration of the question into an unprofitable channel. I cannot, however, literally embark upon "Municipal Rehousing" without saying a few words about displacements and the authorities empowered to act.

The Housing of the Working Classes Act of 1890, with the Amendments of 1894, 1900, and 1903, dictate the procedure in regard to insanitary areas.

Part I. provides for clearing extensive insanitary areas and carrying out schemes for improvement in connection with them. For the County of London (excluding the City) the London County Council is the proper authority for proceeding under Part I. The Medical Officer of Health in any district is under obligation whenever he sees cause or upon complaint

as to any area by two Justices of the Peace or twelve or more ratepayers to make a "representation" or official report to the County Council that the area is insanitary, which means: That houses, courts, or alleys therein are unfit for habitation; that the narrowness, closeness, or bad arrangement of streets and houses, the want of light, air, and ventilation, or any other sanitary defects within the area are dangerous, or injurious, to the health of the inhabitants of the buildings on such area or of the neighbouring buildings.

If the area is situated in the County of London (excluding the City), and the Council is satisfied that the representation is justified, it may pass a resolution declaring that the area is unhealthy and that an improvement scheme ought to be made; such scheme must be accompanied by plans and estimates. There is discretion allowed as to including the whole of the property represented. Further, property may also be acquired in order to sufficiently open out the area and provide for suitable sanitary arrangements. Accommodation must be provided for at least as many persons of the working class as will be displaced, and this accommodation must be within the limits of the area or its vicinity. In Clause II. of the Amendment of 1903 this is modified as follows in regard to rehousing under general act other than the Housing Act:—"The Housing scheme shall make provision for the accommodation of such number of persons of the working class as is, in the opinion of the Local Government Board, taking into account all the circumstances, required, but that number shall not exceed the aggregate number of persons of the working class displaced; and in calculating that number the Local Government Board shall take into consideration not only the persons of the working class who are occupying the working-men's dwellings which the undertakers have power to take, but also any persons of the working class who, in the opinion of the Local Government Board, have been displaced within the previous five years in view of the acquisition of land by the undertakers." The Secretary of State has discretion to allow the accommodation to be provided elsewhere and to reduce the rehousing obligations to the extent of one-half, but in November, 1898, the London County Council decided that, in their own operations, they would ask for no relief in regard to the number to be rehoused, and from that date provide accommodation for as many persons as were displaced. The power of the Secretary of State may, by Clause II. of the General Amendment of 1903, be assigned by His Majesty's Order in Council to the Local Government Board.

The scheme must be advertised for three consecutive weeks in a newspaper within the district of the local authority, and a petition accompanied

by a copy of the scheme and other information sent to the confirming authority (*e.g.*, the Home Secretary for Part I. schemes who, if he sees fit, directs a Local Inquiry to be held). If the report of the Inquiry condemns the area, the Secretary of State may issue a provisional order confirming the scheme, and this order must be subsequently confirmed by an Act of Parliament.

Compensation to the owners of the property in the unhealthy area must be assessed in the following manner:—

The estimate of value of lands, or interests concerned, is to be based upon the fair market value at the time of valuation, due regard being had to the condition of, and probable duration of, the buildings in their existing state.

Abatements in value are to be made if the property has been enhanced by being used for illegal purposes or for overcrowding, or if the premises are in a bad state of repair, or if the property cannot reasonably be made fit for habitation.

The receipts arising from a scheme which has been matured are earmarked for what is called a "Dwelling House Improvement Fund." Out of this fund all expenditure has to be defrayed, and the necessary further outlay required for the purpose of the Act may be borrowed on the security of the rates.

Previous to the passing of the Act of 1890, the Metropolitan Board of Works had initiated and carried out clearance schemes under the various Artizans' Dwellings Acts, 1875 to 1882. 21,207 persons were displaced, and accommodation was provided in new dwellings for 27,066 persons, the cleared sites having been sold to dwellings companies and others for this purpose. The Metropolitan Board of Works had also initiated other clearances, displacing 6,188 persons; the completion of these schemes was carried out by the Council, and dwellings erected on the cleared sites under Part I. of that Act to accommodate 2,930 persons. Under Part I. the Council has initiated and carried out, or is proceeding with clearance schemes displacing a total of 14,784 persons, and when all the new dwellings in connection with these schemes have been completed a total accommodation for 14,970 persons will have been provided.

Part II. may be briefly described as a diminutive operation on the lines of Part I.

The Borough Councils as well as the London County Council are empowered to act and the Local Government Board is the confirming authority.

Under this part of the Act the Council has initiated and carried out four schemes displacing 1,855 persons, and accommodation has been provided in completed dwellings for 2,314 persons. The Borough Councils have undertaken schemes involving the displacement of 4,123 persons, and when the new dwellings are completed accommodation will have been provided for about 3,000 persons.

Displacements under Special Acts.

Great improvements are carried out by Special Acts of Parliament, but the rehousing obligation in all cases is practically based on the foregoing procedure.

Under Street Improvement Schemes, the Metropolitan Board of Works by the sale of sites to dwellings companies provided accommodation for 10,688 persons.

The Council, under their improvement schemes, completed and in hand, will have displaced 15,257 persons; and on the completion of all the dwellings proposed, accommodation will have been provided for 16,430 persons.

Railway companies and other large corporations, whose operations in any one scheme involve the displacement of 30 or more persons of the working classes, must under Clause 1 of the Schedule of the Amendment Act, 1903, rehouse under the discretion of the Local Government Board. In addition to these cases of displacement, there is an insidious process of destruction of small residential property constantly taking place in the county through private enterprise, and this where there is no obligation, either under the Housing Act or under any special Acts, for those interested to rehouse. In the past three years, building of property which has been brought under the notice of the London County Council has involved the displacement of 6,570 persons, but the proposals did not provide for rehousing more than one-third of that number, and there is no authority charged with seeing that the rehousing proposed is carried out.

These details are quoted in order to show the strong reasons that are continually operating to justify the resolution of the London County Council of November, 1898, to seek no relief in regard to their obligations to rehouse.

Overcrowding.

To make clear to your mind what is meant by overcrowding, I ask you to note that it has been laid down in the operations of the London County Council that not less than 400 cubic feet of air space shall be provided

per person in their dwellings (for children under 10 years, 200 cubic feet), and that in any tenement the total number of persons should work out at not more than two to a room, but infants born in the tenements do not count until they attain five years of age, when they are reckoned as half an adult up to the age of ten years.

The last Census Returns (for 1901), giving detailed statistics of the population and houses in London, are full of interesting and useful information in this connexion. The number of persons per room, however, is given irrespective of age.

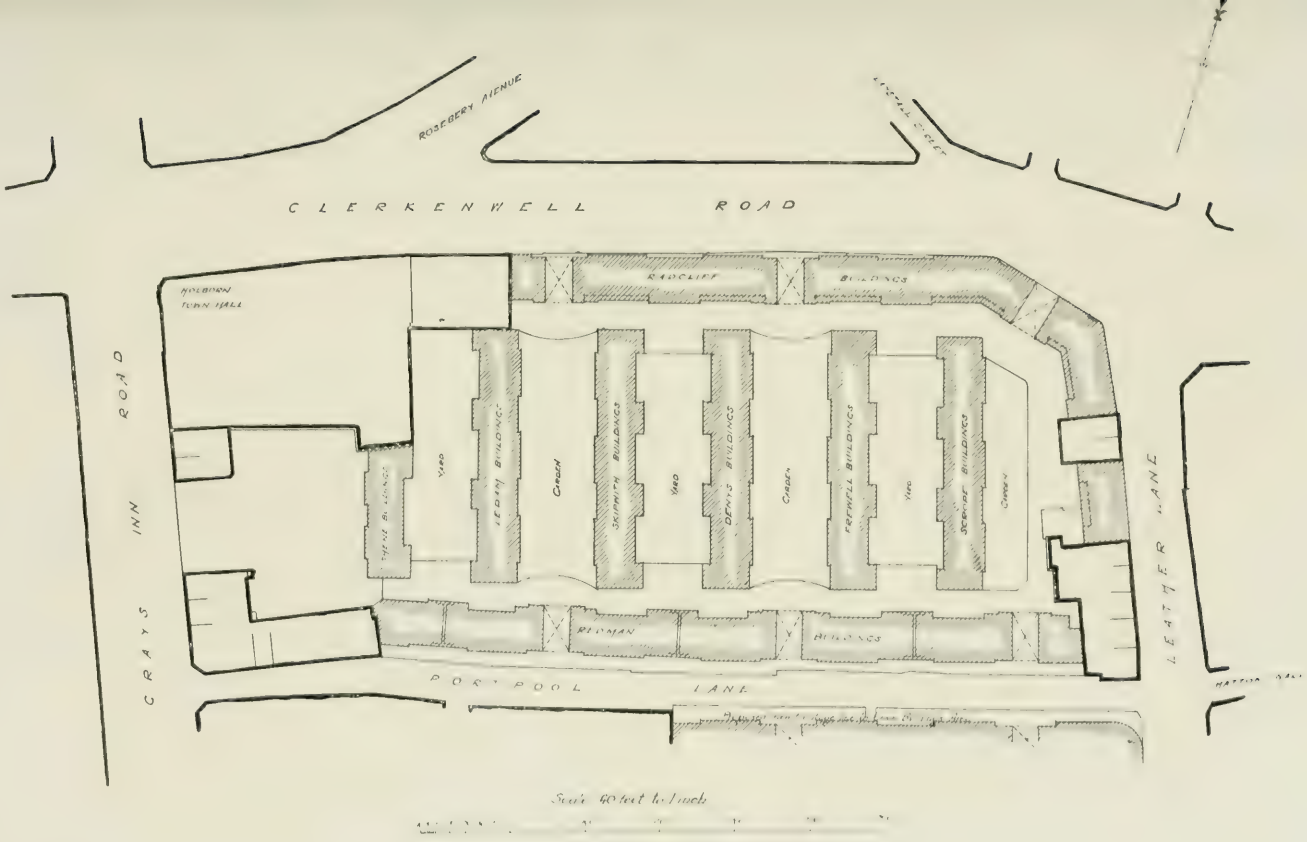
We learn that the population increased during the ten years 1891 to 1901 from 4,228,317 to 4,536,541. Notwithstanding this increase of 308,224 (7·3 per cent.), the number of single-room tenements in which more than two persons were "enumerated" declined from 56,727 to 40,762—a very remarkable decrease, indeed; whilst the number of one-room tenements with six or more inmates fell from 4,097 to 1802. With regard to the one-room tenements occupied by more than two persons, not only do we find a reduction in the number of such tenements, but, more important still, a reduction in the average number of persons occupying those tenements—the number per room in 1901 being 3·62, as against 3·80 in 1891.

Moreover, the number of persons living more than two in a room in tenements of one to four rooms decreased from 831,668 in 1891 to 726,096 in 1901, or from 19·66 per cent. to 16·0 per cent.

Generally speaking, not only the amount, but the intensity, of overcrowding has been reduced, the greatest reduction having taken place in the most significant instance of all—i.e., in the case of one-room tenements, from 172,500 to 149,500 tenements; and, summarising the results under two main heads, it is found that

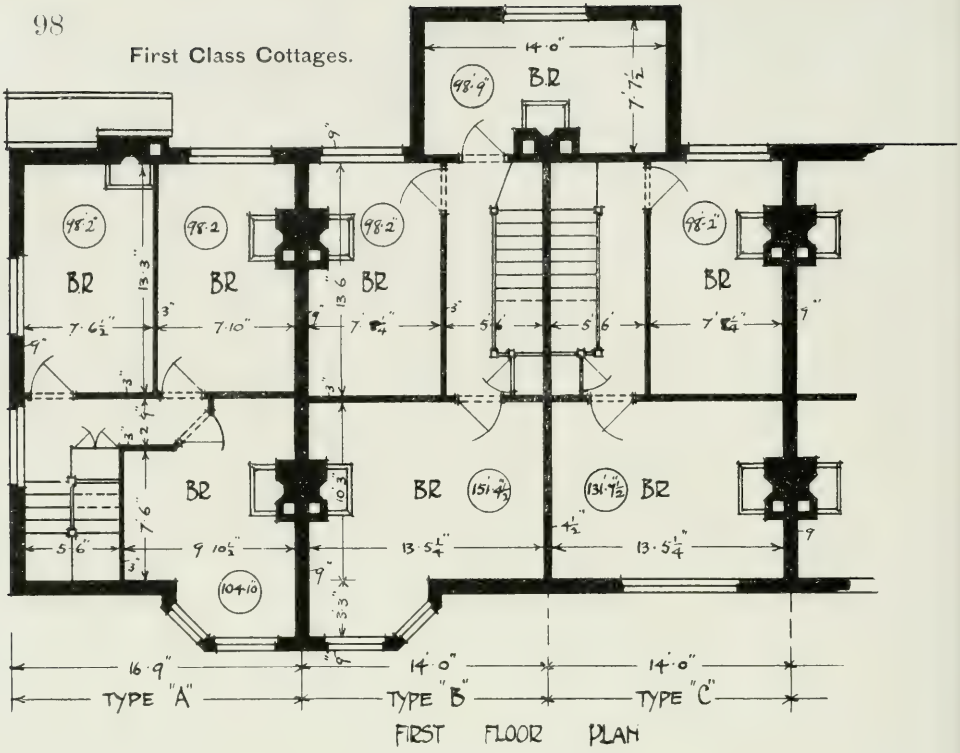
> Tenements of less than five rooms have increased 6·3 per cent., while the population occupying such tenements has only increased 4·7 per cent.;
>
> Tenements of five or more rooms have increased 12·5 per cent., while the population occupying such tenements has increased only 10·4 per cent.

The meaning I attach to "rehousing" is illustrated by a case which came before the magistrate at Bow Street on the 12th July, 1899. A poor woman, occupying a tenement of two rooms on the third floor of Windsor Court was required to vacate her rooms in connection with a clearance scheme. One of the rooms she occupied had an area of 184 square feet, and the other, which could only be regarded as a box-room,

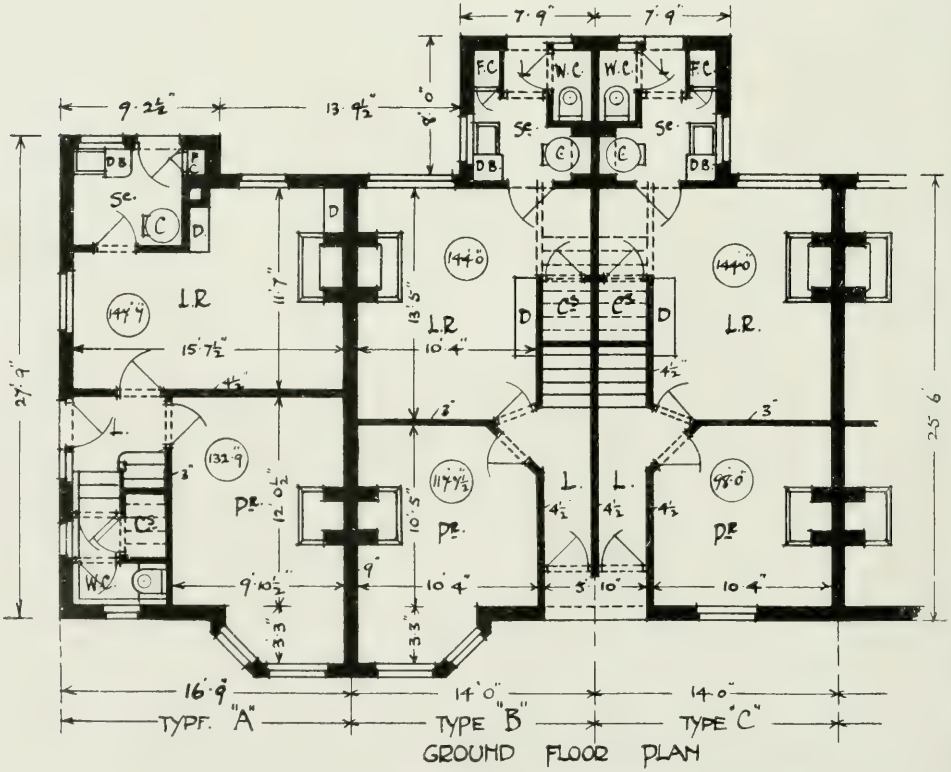


THE BOURNE ESTATE.

London County Council Holborn to Strand Rehousing.



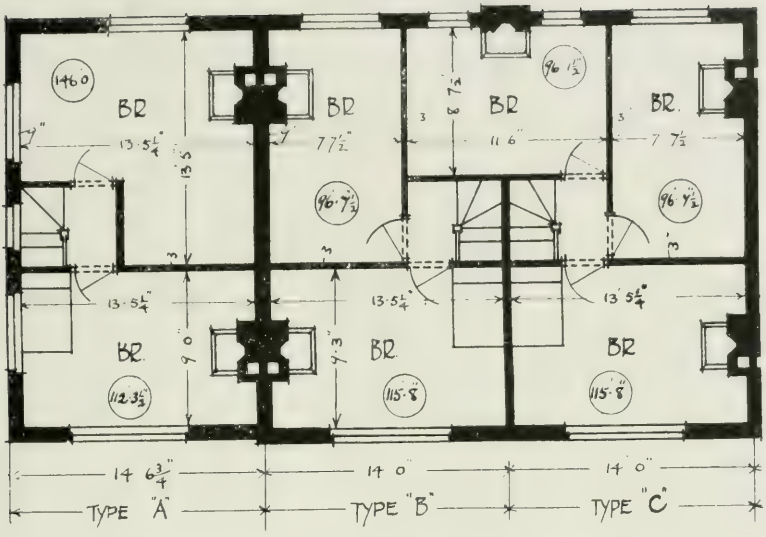
FIRST FLOOR PLAN



GROUND FLOOR PLAN

L.C.C. WHITE HART LANE ESTATE, TOTTENHAM.

Second Class Cottages.



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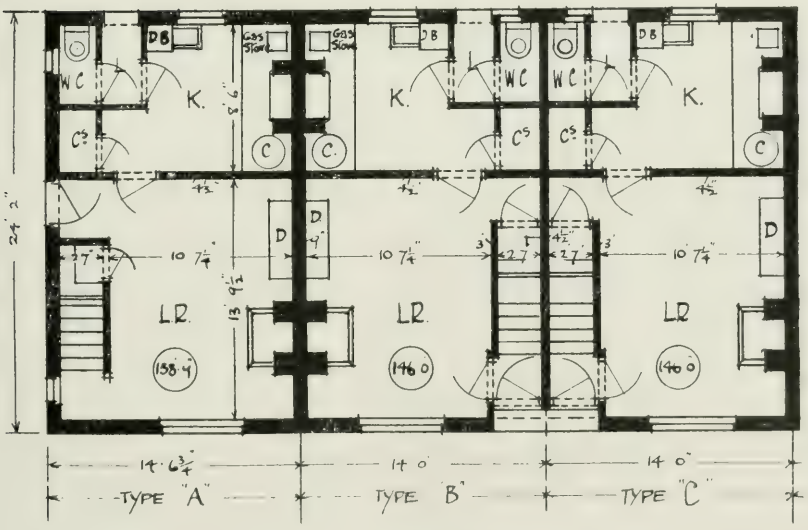
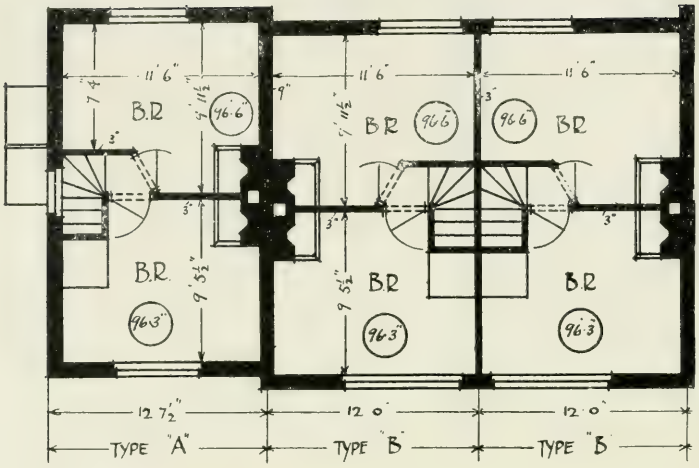


GROUND FLOOR PLAN

L.C.C. WHITE HART LANE ESTATE, TOTTENHAM.

Third Class Cottages.



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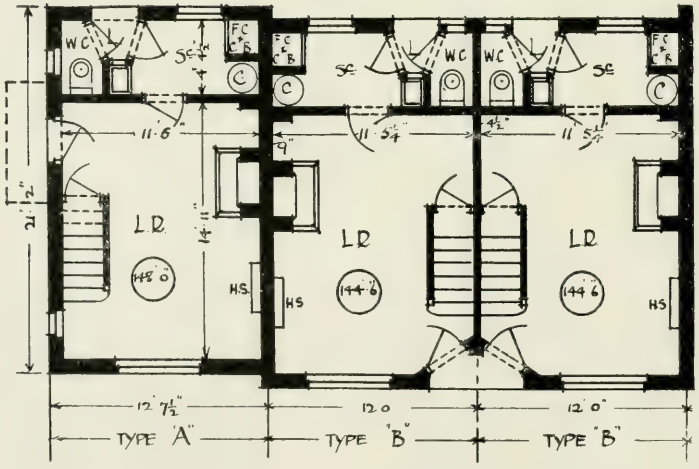


GROUND FLOOR PLAN

L.C.C. WHITE HART LANE ESTATE, TOTTENHAM.

lighted from a well-hole used for storing lumber, was 54 feet super. The sanitary convenience was entirely inadequate, and was common to four tenements. Besides herself the family comprised her husband and four children, and one living away from home. The rent paid was 5s. 6d. per week. As she would not leave, the Council applied for an ejectment order, and she told the magistrate that she could not afford to rent one of the Council's tenements, which was reserved for her at Millbank and would have cost her 8s. 6d. per week. The tenement offered her comprised a living-room, 144 square feet; one bedroom, 120 square feet, and a second bedroom over of 145 square feet; with a scullery and independent sanitary convenience. This accommodation would have allowed the fifth child, the eldest daughter, to live with her parents, which she was unable to do at Windsor Court, and was the minimum standard of accommodation that the Home Office would approve as suitable for such a family. She was paying weekly 2s. 3¾d. for each 100 feet super under the old insanitary conditions, whereas the Council was in a position to rehouse her family in a thoroughly sanitary way without any charge on the rates, at a little over 1s. 10¼d. The magistrate remarked that the rent charged by the Council was too high, and should begin at 6s. per week in order to allow persons so displaced to live at Millbank without much increase of rent. No comment was made on the proportional increase of area required by such a family to conform to the provision of the law, or what charitable authority should provide and pay for the needful additional room for their proper accommodation. The economy in bricks and mortar could not be made, and, therefore, in this case the magistrate's criticism advocated a charge on the rates. He reluctantly allowed the ejectment order, but gave full time for compliance, *i.e.*, 30 days.

This and similar cases appear to need some answer by those who waste their energies in criticising the rent level and the dwellings built by the London County Council. They do not understand that the operations of the Council in this work have necessarily to be conducted on a sound financial basis.

It may be accepted as a broad rule that the price of land and the most economical use of it govern the maturing of any housing scheme in the central districts of London.

It generally costs 15s. to 17s. per foot super to clear slums in central districts, but very few housing schemes can be made to pay if the charge for land alone is more than 5s. per foot.

In bringing the idea home to your minds of the necessity of obtaining some kind of financial support in dealing with this part of the problem,

the handsome donations which started the Peabody Fund and the Guinness and Hales' Trust Funds may be cited as examples which have enabled charitable individuals to initiate vast housing operations which have subsequently been carried on with great benefit to the poor without financial embarrassment.

The price paid by ratepayers for clearing areas and rehousing the poor upon them is an investment which it is presumed repays itself in better sanitary conditions and in the general welfare of the community.

The following particulars relative to the mortality in the Council's dwellings for the year 1903 may be of interest.

The death-rate from all causes was 11·8 per 1,000 living, as compared with 15·2 in London as a whole.

Taken singly the population of the various blocks are not sufficiently large to give reliable results, except, perhaps, Boundary Street Estate, which has a population of between 4,000 and 5,000. At Boundary Street the death-rate works out at 12·7 per 1,000 living, as against a corresponding rate in Bethnal Green of 18·2. It may be noted that the death-rate when the insanitary area was represented was 40·1 per 1,000 living.

Rehousing which has been effected.

The statistics on the question of rehousing the displaced persons in the dwellings built for their accommodation is not on the whole very encouraging.

In 1897 a return was made showing the particulars of the number of persons residing in new dwellings who were displaced or removed from areas cleared by the Council.

Of the 1,210 displaced by the Blackwall Tunnel works, only nine of them took advantage of the new accommodation.

Of the 5,719 displaced in the great Boundary Street clearance scheme, although accommodation had at that time been provided for 1,500 persons, eleven only were living on the area.

There are necessarily rules and regulations enforced in the management of dwellings, and the dislike of the slum inhabitant to any semblance of supervision probably accounts for the fact that so few avail themselves of the new accommodation. As an illustration of this, it may be mentioned that 100 of the families displaced in the initial stages from the Boundary Street Area were fortunate in finding accommodation in the new buildings of the Guinness' Trust just then completed, viz., Columbia Buildings; but I am informed that not one of these families remained in occupation three months afterwards, the reason given to me being that

they would not accept the discipline and control. Returns have been made which bring this interesting portion of the question up to a recent date.

In the Falcon Court scheme, sanctioned by the Local Government Board on the 12th July, 1898, the number of persons displaced was 800, the number for whom new accommodation was provided was 500, and about 40 persons availed themselves of the new accommodation.

A large scheme at Millbank afforded special facilities for rehousing persons whom it was proposed to displace in certain projected improvements, *e.g.*, the Clare Market Scheme, the Westminster Improvement, and the Holborn to Strand Improvement. There are 17 blocks of dwellings providing accommodation for 4,430 persons in 895 tenements, and much of this accommodation was built in advance of the displacement under the various improvement-schemes. On the 7th October, 1902, when all the blocks were completed, 22 of the tenants displaced at Westminster, and 3 from Clare Market, were then in occupation.

A better result was obtained in the rehousing-scheme for the Clare Market and the Holborn to Strand Improvements. It was laid down as a condition of approval that in the immediate vicinity of the improvement accommodation should be provided for 1,000 of the persons displaced. Sites were acquired in Drury Lane and York Street, and great care was exercised to obtain as far as possible the full details of the accommodation required for the various families it was intended to displace, and the plans of the 5 blocks of dwellings which were finally decided upon provided as closely as possible the accommodotion needed. A return was made in October, 1902, showing that the whole of the tenements in Drury Lane had been occupied by persons actually displaced in connection with the improvements. The buildings provided provoked a good deal of adverse criticism, and some effort was made to draw comparison between the rooms vacated by one of the tenants and those which had been provided in the Council's dwellings. Irrespective of the dilapidated and insanitary condition in which the vacated property was found to be, the rent per foot super paid by the tenant was about 4s. 4d. per annum, cheaper in the new dwellings than in those vacated. The cubic space was 8 per cent. more, an independent water-closet, a scullery with boiling-copper and sink, were provided in addition, as against one water-closet and one sink used in the vacated quarters by three tenants. The balance of the accommodation needed was provided at York Street, and I was informed in November of last year that the tenements in those dwellings also, with few exceptions, had been filled by the dishoused persons.

In connection with Rotherhithe Tunnel Scheme, an estate is nearing completion which is intended to accommodate the persons displaced by that work. The dwellings were again provided in part before any displacements were made, but the proportion of persons who availed themselves of the new accommodation was small, and the privilege of offering tenements to other persons about to be displaced in order to forward the work has been granted. The total accommodation which will be provided when the estate is completed will be sufficient for 1,200 persons. The rents are low and the accommodation has been carefully designed in order to meet the wants of those displaced, and it is, therefore, somewhat disappointing to find that numbers of those tenements are still unlet, entailing charges on the Tunnel Scheme.

In the foregoing remarks I have not touched on the very excellent work done by Glasgow, Liverpool, and other provincial towns in connection with Municipal Rehousing. In Glasgow, under the Improvement Act of 1866, powers were given to the Corporation to reconstitute various portions of the city which were insanitary. The powers entailed the obligation of providing accommodation for the working and poorer classes displaced by the erection of suitable dwellings. In 1901 there were 1,500 tenements in blocks accommodating 7,000 persons already erected under the Act of 1866. There is a family-home containing 160 single rooms, each capable of accommodating an adult and three children, and six lodging-houses for men, and one for women, which inclusive of the family-home accommodates about 2,700 lodgers. A new Act was obtained in 1897 entitled "The Glasgow Corporation Improvement and General Powers Act," under which the Corporation were authorised to deal with certain insanitary areas and to acquire additional land not exceeding twenty-five acres within the city or within half a mile of the city-boundaries. This Act entails many of the restrictions of the Housing Act, and will probably be found to hamper the freedom of the earlier housing-operations carried out in Glasgow.

The earlier schemes in Liverpool were carried out under the Liverpool Sanitary Amendment Act passed in 1864. It is claimed that the insanitary property can be acquired more economically than under the Housing of the Working Classes Act of 1890, the local Act being more rapid in procedure. The portions carried out under this Act up to 1901, on the whole, involved a charge on the rates.

It has not been possible in this short time to do more than indicate in outline the general procedure in Muncipal Rehousing. With the increased financial difficulties, the problem of providing suitable accommodation is

becoming more acute in every scheme which is developed. The Amendment Act of 1903 appeared to hold out the hope that the redemption period might be extended to eighty years, but the recent Treasury decision against the extension of the period so far as the cost of erection is concerned has deferred the realisation of that much desired relief for an indefinite time.

Mr. E. Bond, M.P. (London) in proposing a vote of thanks to Mr. Riley for his instructive and interesting paper, said that their thanks were specially due to Mr. Riley for the colourless and impartial way in which he had presented the subject to them, without any rhetorical flourishes and without any attempt to make things out to be better or worse than they really were. Only two expressions could he take the slightest exception to: one was as to the "insidious" process going on in the destruction of small residential property through private enterprise. He did not think the word "insidious" should be used, because it seemed to imply something improper in persons dealing with their property if such dealing involves the pulling down of houses inhabited by the poor. The other exception he desired to take was to the concluding remark to the effect that all the housing-companies which have taken part in the reconstruction of London have received assistance in some form or other from more or less charitable action. As far as the Company with which he was connected was concerned, that statement could not be said to be true, except perhaps in regard to one or two sites which in the early days of the Company were acquired from the Metropolitan Board of Works. But there the advantage which the Company gained was precisely the advantage which the London County Council gives to itself. If the Council takes advantage of a scheme under the Artizans' and Labourers' Dwellings Act, as Mr. Riley had very properly pointed out, the general cost of acquiring the site is not charged to the particular housing scheme. The cost of acquiring the site is written down very considerably in order that the site may be brought to what is called housing-value, and the balance of the cost, usually a large sum, is written off as representing sanitary improvements of the Metropolis. To the extent mentioned, his Company had the advantage of obtaining one or two sites acquired by the Metropolitan Board of Works; but he wanted to go beyond that, and to say that his Company had found it equally easy to deal themselves, in an entirely commercial way, with slum-areas. They had in several instances bought slum-areas, had cleared them, and had been able to charge the whole cost of the site against the housing-scheme, and yet were able to make it pay without any loss being inflicted upon the ratepayers or anybody else. He did not say that could be done in all cases, and he did not want to disparage the work done in clearing unhealthy areas. In

some areas that would be impossible owing to the multiplicity of interests, and a considerable sum would have to be paid for removing the great defects which might have grown up through neglect, faulty administration, or bad usage of property in the past. The subject they were asked to discuss was of immense importance and very considerable interest, but it was probably a simpler question in some of its aspects than most of them were accustomed to consider. The question of rehousing or housing (each ran into one another) was really a question of ordinary economics; it was a question of the relation of means to objects of desire; it was a wages-question—a question of what people can afford to pay for accommodation. There was plenty of accommodation to be had by people who could afford to pay for it, provided in an ordinary commercial way by people to whose interest it is to furnish such accommodation. The real difficulty arises from the fact that there is a large, though he hoped a decreasing, section of the population which is not able to pay for reasonably decent house accommodation. Though on the one hand wages have risen considerably, on the other hand, recently, at all events in London, the cost of providing house-accommodation has risen out of proportion to the rise in wages. His experience was that to erect accommodation for the labouring classes costs a very great deal more, something like 30 or 40 per cent., than it did when his Company commenced operations. That condition was due, not so much to increase in the cost of land, but almost entirely to the rise in wages in the building-trades and to the rise in the price of building-materials, and to some extent also to the greater stringency of the regulations which have been made by the local authorities with the object of securing better buildings and of insuring that such dwellings as are put up shall be more thoroughly sanitary and healthy. That brought him to the point as to whether it is desirable for local bodies, such as the London County Council, to go into the business at all. The reasons given for so doing did not seem to him to be conclusive. The popular argument which was generally relied upon rested on the fact that there was still an immense amount of overcrowding in the Metropolis. It was also realised that there are many slums in which a large proportion of the population lives under discreditable, insanitary, and loathsome conditions, slums that ought to be cleared away and replaced by better dwellings in which some at least of the displaced people can live. Upon that ground largely the housing-policy of the London County Council had commended itself to popular favour. But when they examined into that argument and into the proceedings justified by that argument, they would find that the whole thing is a delusion and a sham. Mr. Riley had given them some interesting particulars as to the extremely small proportion of the people displaced from any given area which is able to occupy, or as a matter of fact does occupy, the dwellings which have been put upon the cleared area. Of course, it was perfectly obvious that people who have been accustomed to pay five or six shillings for their rooms (the utmost they can afford out of their scanty wages) cannot go into dwellings the rents for which are perhaps 7s. 6d. or 8s. 6d. Everyone knows

that a shilling a week in the budget of the families under consideration makes a very appreciable difference; indeed, even sixpence a week makes a great difference, as he had recently occasion to learn. Was it worth while then for the County Council, if it cannot solve the problem, if it cannot provide dwellings which the people turned out of the slums can occupy, to attempt the thing at all? There was no lack of accommodation of the kind required by the aristocracy of the working classes, those who can afford to pay 8s. to 12s. a week for their house-accommodation. Plenty of such accommodation could be got without the County Council intervening. Now the Tottenham estate was one of the most extraordinary departures which the Council had yet taken in this direction. First, the estate was entirely outside the county area. He did not know whether it was proposed to confine the accommodation on that estate to people who worked in London; if that were attempted he thought it would be found to be very difficult to carry out. As a matter of fact, he thought they had been told that in connection with the Totterdown estate at Tooting an appreciable proportion of the population there, were not persons whose work lay in London. If so, then the Tottenham estate became a purely building-speculation. How obviously that was the case was, he thought, shown by the fact that the estate was contiguous or nearly contiguous to another estate known as Noel Park, which belongs to the Artizans' and Labourers' Dwellings Company. To show that the Tottenham estate was not altogether a wise scheme, he thought he was at liberty to say that the Artizans' and Labourers' Dwellings Company have found the Noel Park estate something of a white elephant. They bought a very large tract of land there and built upon it very much the same kind of house that the County Council is putting upon their Tottenham estate, and they very soon found that they had outrun the demand. A large part of the Noel Park estate remains unbuilt upon to this day, and until recently the Company had ceased operations altogether upon that particular property. Well, the County Council, not content to leave that Company to develop the area and provide the sort of accommodation that is required, go into the market, buy this large estate, on which at one time it was contemplated putting down a population of 42,000; that seemed to him a speculation which the Council had no right to enter upon with the ratepayers' money, especially as it was not, as far as he could see, a speculation which was likely to turn out very well from a pecuniary point of view, while the benefit to the persons occupying the dwellings was nil. Mr. Riley said the cottages there had three bedrooms and two living-rooms, with scullery and offices, and were let at 12s. a week. Now that rent was rather an outside rent for cottage-accommodation in the suburbs of London.

MR. RILEY: There are no rates or taxes.

MR. BOND admitted the fact, but said he had himself a few cottages of a similar kind at Wood Green, in the same neighbourhood, and they were let at a

lower rent, which also included rates and taxes. He thought it would be found that the market was well stocked in that particular neighbourhood with houses of that kind, and that the Council would not be able to command so high a rent for their Tottenham houses. At all events, a return of a gross 12s. a week upon the stated cost of such houses did not appear to him to be a very profitable speculation, even if it were the business of the Council to go in for such speculation, which, for his part, he was very unwilling to admit. He thought it was quite clear that accommodation of that kind could be had by any persons who could afford to pay for it. Anybody who went about London with his eyes open could not fail to see North, South, East, and West, whole villages of such houses springing up. It might be that extra amenities would be provided under the County Council scheme, but he was not aware that anything of that kind was yet being seriously attempted. It had been the misfortune of London to be composed of an aggregation of villages. The whole of East London had been constructed in this way; the hamlet of Bethnal Green must, at one time, have presented a similar appearance to the Tottenham estate, except that we have improved somewhat in our cottage-architecture. A sort of new Bethnal Green was being stuck down in the north-east suburbs; it could not be helped, it was the way we do these things and we have to submit, but he did not think it was particularly judicious for a local authority to take upon itself to assist that kind of development more than was necessary, however legitimate it might be to deal with unhealthy areas which could not be acquired in the first instance by private purchase owing to the number and complexity of interests involved. He thought therefore that the legislature, which was not always wise, was wise at the start in laying it down that the acquiring authority, which was then the Metropolitan Board of Works, should not itself build until it had endeavoured to sell the site to an outside body for building-purposes. From that wholesome rule, under various influences, the legislature departed some time since, and had gone the length of passing Acts which enabled the local authority to build speculatively, and of these schemes Mr. Riley had given them some account. He thought it was difficult to say that this kind of work did anything towards solving the problem which they were all anxious to solve, a problem which he did not think was capable of solution by any one drastic remedy, the problem of providing that everybody should have wages or income enough to enable them to live wholesome and decent lives. If that came about at all, it must come about by the operation of economic forces and by a general desire not only on the part of those who want to solve the problem, but also on the part of those who are immediately interested in the question—the people who have to earn their livelihood by the labour of their hands or brains, and those who employ them. He did not pretend that he had himself any solution to offer, but he did say that if they were going to employ public money for rehousing purposes they ought to make the strongest endeavour to provide, without throwing any burden on the rates, dwellings that people who now live in

the slums would be able to afford to live in. This was rendered difficult by the fact that a public body did not like to put up dwellings which will not stand the closest possible scrutiny, both with regard to method of construction and appearance. In Drury Lane he understood an effort had been made in that direction. He had not seen them, but he understood hostile criticism was directed at them because of the scantiness and shabbiness of the accommodation there provided. Well, that criticism had to be faced, and if they were to do any good with these schemes undertaken at the public expense they must submit to such criticism if they were to render more tolerable the lives of those people turned out of the slums. People did not altogether live in the slums because they liked the slums, but mostly because the houses were cheap, or cheaper than houses they could get elsewhere, and also partly because they were sometimes convenient for work. The only way to help those people was to clear away the slums and put in their place houses of an unpretentious kind, not four or five-roomed tenements, but one and two-roomed tenements which can be let without throwing a burden on the rates at a rent which the displaced persons can afford to pay. He thought that a great deal could be done by the plan which Miss Octavia Hill had popularised, viz., the plan of taking over blocks or streets of old dwellings, and sending down to them as rent collectors men and women of kindly nature, who would take an interest not only in the collection of rent but in the lives of those who pay the rents. In this way a great deal could be done towards civilizing the least civilized areas in London. In this connection he would like to draw attention to an article by Miss Alice Lewis which appeared in the *Economic Review* of April, 1900, giving experience of a most interesting kind of such work as that he had indicated. Miss Lewis told how she had reclaimed one of the worst slums in this manner, a slum which had defied police attention for years. Having quoted at length from this article, which ended with the statement that in this whilom den of thieves the tenants came to leave their doors unlocked and the rent on the table for the collector while they went on errands, Mr. Bond concluded by again thanking Mr. Riley for his interesting paper.

Mr. Alderman Thompson (Richmond) said, as one who held the opinion that any activity in the direction of providing sanitary dwellings for the people should receive every encouragement rather than any discouragement from those interested in sanitary matters, it filled him with dismay when he heard the suggestion made by Mr. Bond that they should not take an active part as sanitary authorities in the prime necessity of providing better sanitary conditions by means of healthy dwellings for the people. Mr. Bond's suggestion seemed to be that there is plenty of accommodation for people who can afford to pay. That suggestion contained a fallacy. There was not plenty of accommodation for those who can afford to pay; the ordinary artizan earning good wages and with a family cannot find, at the rent which he can afford to pay, proper and suitable accommodation in or near London. He wanted to make perfectly clear

the view that he took, and the view that the working classes took. Having been closely in touch with them, he could say the view they take was that private enterprise had not built a sufficient number of new dwellings, and had not in such new dwellings provided suitable accommodation for the workmen and their families, let alone for the unskilled labourer. All round London, a few miles out, they would find very few decent cottages for working men, or houses suitable for occupation by the working classes. Directly any decent dwellings were provided, or when there was a clearance, as at Boundary Street and elsewhere, there was a tremendous pressure on the part of the working classes to obtain the accommodation. Yet great masses of respectable artizans live under unhealthy conditions. In an area not far from that place, not a slum-area, there were children of some 200 families attending an average Board school, and 80 per cent. of those families were living in two rooms, in those block-tenement houses which are to be met with in the middle zone of London, with insanitary conveniences, and not any separate entrance from the street, with four or five families in one house, and paying a rent of something like 6s. 6d. to 8s. 6d. for the two rooms. But the matter went beyond even that; persons in receipt of incomes from £100 to £250 a year could not get satisfactory accommodation. They could go round to the suburbs and see rows of bay-windowed houses provided for persons earning £300 or £400 a year, but let out to two or three families, although without proper sanitary conveniences for so many occupants. They were streets of whited sepulchres. How could it be said that private enterprise met the difficulty when it had not provided the right type of house? It therefore became the duty of some authority to step in and provide the type of dwelling more suitable to the needs of the working classes. If private enterprise would do it there was no need for municipal action. Mr. Bond said that he did not think it was desirable that local authorities should do this work. But it was not a question of being desirable or undesirable, it was a case of necessity. Without the strong action on the part of the London County Council they would not have seen the marked reduction in the one and two-room tenements. This was a point lost sight of by those who criticised the action of the Council, the fact that there had been a slow, steady improvement in the condition of the masses of the people. Now the practical question was, what were they going to do and what could be done in regard to this great question? First of all, he was glad to think there was a tendency on the part of nearly all local authorities to abandon the system of block-dwellings. He had been very pleased to hear Mr. Riley's remarks on the subject. There was objection to block-dwellings on all grounds; they cost twice as much to build, and the sanitary results were worse. The death-rate in block-dwellings was always higher. Recently he had taken the trouble to investigate this aspect of the question, and in dwellings owned by various companies in London he had found that the death-rate was 30 per cent. higher than the average death-rate of the County of Surrey, which had all kinds of dwellings mixed up together, including slums.

Mr. Bond: The death-rate in the dwellings I am connected with is 12·7 per 1,000.

Mr. Thompson: Yes, but probably only for one particular year or so, and without the usual percentage of children and others more susceptible to disease and death. He urged that those living on the ground-floor of dwellings vitiated the air breathed by those living in the upper storeys. Air-space was reduced, sunlight excluded, and a generally lowered vitality resulted. This was proved by the experience of large towns like Glasgow or Paris, where block-dwellings were numerous. He contended that as a rule the highest death-rate would be found in those towns where there was the largest number of families crowded on to a given space. This piling of people one upon the other was not only objectionable on sanitary grounds, but also because it was the most expensive form of housing. In the central districts of London the difficulty of rehousing displaced tenants in or near the vicinity of a condemned area should not be met by building these tall and costly blocks, but should be overcome by the admirable plan many times suggested by Dr. Sykes, viz., that of purchasing existing middle-class areas in the vicinity of slums, adapting them for the occupation of three or more families, and providing the proper sanitary conveniences. The Glasgow Workmen's Dwellings Company did this in a very satisfactory manner in one or two schemes which have been tried, and found it paid them one per cent. better than building new dwellings. That was a practical suggestion which ought to be given a trial by borough councils. He did not believe in buying slum-property; slum-property ought to be condemned like any other rubbishy stock, such as bad meat. He believed that Dr. Sykes's plan could be advantageously put into operation in several places, Kensington, for instance, where whole streets could be purchased without inflicting any injustice upon the persons displaced; persons who would be only too glad to get out into the suburbs with a reasonable allowance for their expenses. Proceeding to deal with housing-effort at Richmond, Mr. Thompson said that Richmond was responsible for the first scheme under Part III., the first as distinguished from rehousing. A row of 132 cottages was erected, and the highest rent for six rooms and scullery was 8s. per week, and the average rent for the bulk of the six-roomed houses was 7s. 9d., and some were let at 7s. 6d. These cottages had paid remarkably well, there being an accumulated fund of three or four thousand pounds, and £500 a year was contributed in relief of rates. The advantages to these tenants in the way of health could be proved by instances coming under his own observation, and there were the indirect advantages of the bread-winner not being laid by periodically. The people gained more in self-respect, and the benefit to the community was consequently obvious. The great point was to have dwellings of a suitable type, with low rents; here the rent was 8s. against the 12s. charged by the County Council.

Mr. Riley: Our rents go down to 7s.

Mr. Thompson said the Richmond rents went down to 4s. 6d. for two rooms and a scullery, and in every case there was a large garden. In their case the land cost twice as much as the land at Tottenham, and yet a profit was made upon the scheme. The whole difference (and there Mr. Bond touched the spot to a great extent) was the increased cost of building, and that increase was more serious than many people imagined. The cost of building was responsible for nearly half the rent. Out of 7s. 6d. paid in rent for a six-roomed cottage the interest on the cost of building came to 3s. per week; the interest on the site, gardens, and construction of roads and sewers was only 8d. per week; so that no less than 3s. represented the cost of building as against 8d. for the land; the cost of roads and sewers would work out at something like £1,200 per acre. Thus the increased cost of building was a serious factor. He thought that was due to preventible causes, and largely due also to the stringent regulations of the Local Government Board and the over-insistence of certain sanitary faddists. Some municipal buildings he had seen were erected more like fortresses than cottages: solidity and substantial structure had been carried to excess; they were too well built. It was a good fault, of course, but in view of prevailing conditions, open to objection. The Richmond cottages were good enough for all practical purposes, and were better built than a good many private villas; they were built to last for 100 years and cost very little to keep in repair. In other cottages built by the municipality he had noticed several things; for instance, great chunks of concrete separating the roofs. That did not add to the beauty, and was certainly an unnecessary expense. Of course, this expense was due to the regulations of the Local Government Board and to the provisions of the London Building Act, which requires that the party-wall shall be carried through the roof. It was supposed to be a protection against fire, but in cottage property the risk of fire was extremely small, and in that type of house it was unnecessary to incur that extra expense. Then there was another absurd condition: the construction of the third bedroom of a workman's cottage by means of a back addition, which meant an enormous expense. Over and over again they had tried to get the Local Government Board to allow a 9-inch wall to carry an attic. There was no real objection so long as the height was not carried up too far. Any practical builder or architect would endorse this view. But no! the Local Government Board said that if there was an attic-floor the wall must be half as thick again, adding 50 per cent. to the cost of the brick work. But he did not want to go into every detail, though many points in connection with the building of workmen's dwellings could be considered with advantage. He did not agree with Mr. Bond that the increased cost of labour was such a serious factor. He had taken Laxton's Price Book and had found there had been nothing like the increase in wages as had been suggested. The increase was more in the cost of the articles used. Mr. Thompson then proceeded to give the figures, showing the advances in cost of labour and materials, respectively, between 1894 and 1900 in connection with the Richmond

cottages. He urged the importance of modifying the specifications in certain points so long as sanitary points were not affected, and added that as there was a paramount necessity for providing sanitary accommodation for the working classes, all these things would have to be duly considered. He hoped that the County Council would be encouraged to go on with its work, but he hoped the type of dwelling would be reconsidered, lowering not the standard of sanitation or comfort, but to some extent the standard of building-construction. He believed it was possible for the County Council to put up houses with six rooms for much less than £395.

Mr. Riley said the smallest County Council cottage cost £204.

Mr. Thompson said he believed even that cost could be reduced by the adoption of a less rigid style. This was not the fault of the permanent officials, but of the powers that be, who laid it down that everything must be done according to rule, which by no means made better and more sanitary dwellings, but which ran up the cost and consequently increased the rents. Fewer fads, less precision on various points, and more elasticity would enable cottages to be erected more cheaply. He believed that operations are much hampered by the establishment of a repairs-fund. His experience proved that such a fund is unnecessary, and imposes a burden upon the tenants far more than the circumstances justify or require, while a simpler style of building would enable local authorities to more easily meet the housing-needs of to-day.

Dr. J. F. J. Sykes (St. Pancras) observed that Mr. Riley had not made it quite clear that rehousing a population of an insanitary area and getting the people into the new houses put up was a very different thing from getting a population into new houses built for a street-improvement. The two populations were of a different class altogether. In the case of a street-improvement, the population of the houses destroyed would probably go into the new buildings, but in the case of the destruction of an insanitary area, the slum-population, each family perhaps existing in a separate room, about the lowest type of population, would not go into the houses built for them, and they could not be compelled. Then there was another point in connection with the Bourne estate: it was not so much a displacement as an improvement, a large brewery-site being occupied by the new buildings. That was to the credit of the Council in helping to send outside London an industry which could be carried on in the country quite as well. That point had not been touched upon in the debate. He would have liked Mr. Riley to enter into the question of the relative merits of internal arrangements of dwellings; this was an important matter, and it was one upon which some of the speakers seemed to have differed. Companies had an advantage over municipalities: they could pick and choose their sites. But the municipality had really no choice of sites; the area had to be dealt with as best it

could; a company could refuse a site. He did not advance that as an argument against the company, but mentioned it as a point of difference between the two methods. Then there was another question: private enterprise had built many good dwellings, but private enterprise had also built execrable dwellings; there was no supervision of construction; the Building Acts did not touch internal construction or arrangement of dwellings. The great danger to London was the wholesale construction of flats with bad internal arrangements, and there was no provision of the law to meet this danger. It was a serious point. Then again, the municipality did not build down (he used the word advisedly) to the class of people whom they dishoused. He sincerely hoped they never would; that would be neither progressive nor moderate, but retrogressive. He did not wish to go into the question of the payment of rentals, but from the sanitary point of view he thought municipal authorities ought to put up dwellings which would bear comparison with any other dwellings of the same class. It did not pay builders to put up small houses, and the result was that large houses were erected, and not being let to tenants of the class for which they were originally intended were sublet. This was where the mischief came in. Such houses would be let out in parts without having their internal arrangements designed for such occupation. Several families would occupy them, and with one bad occupier the house would soon be ruined, and a few such houses would ruin a neighbourhood. This showed the great difference between municipal and private enterprise. If private builders would provide houses of the type which were being built by the municipal authorities, he had no doubt they would be able to compete, because it was a well-known fact that a private individual can do things very much cheaper than a public authority. It was to be remembered that the ordinary house could be as tall as the flat, and if that house was sublet, then just the same result occurred as in a flat, so far as foul air rising up was concerned. Therefore to substitute flats for houses could not be a greater injury. He did not object so much to blocks or flats; what he objected to was subletting houses whose internal arrangements were not designed for sublet occupancy. Perhaps in a ten-roomed house there would be only sanitary and domestic conveniences for one family. This question of internal arrangement had been entirely overlooked by the legislature, and something would have to be done or a serious condition of things would arise from this packing of people closer and closer together in existing houses without adaptation. In his opinion this was a point upon which very great emphasis should be laid.

Mr. C. J. Hair (Southampton) desired to bring forward one practical point as illustrated by what had been done in Southampton, where pretty well everything had been tried in dealing with this problem. Cottages did not pay because enough of them could not be got upon the site. He thought the real solution lay in the double tenement-house: one cottage on the ground-floor, and one on the floor above, going no higher than an ordinary cottage. By this means one-

half the number of party-walls were saved, and other considerable economies were effected. In Southampton they proposed to build sixty-six of these cottages at a cost of £160 a cottage. These three-roomed cottages were the cheapest thing that could be done. The site was in the centre of the town in a slum area cleared seven years back. He was glad to hear the statistics showing that overcrowding in London was decreasing; that was surely a proof that the buildings provided by the London County Council were wanted. If municipal bodies could not afford to house the poor people was it likely that private enterprise would make the attempt? There was little doubt that the undesirable portion of the community could not afford to pay such rent as would give a return for the money expended. If, however, they tried to house the better working classes, giving better conditions, there would be fewer undesirables in the future. The children would grow up better citizens and be able to pay for better dwellings. In the country the difficulty was that the schemes were small; the bigger a scheme the better chance there was of its paying. One present drawback seemed to him, that Councillors were losing interest in the question of the housing of the working classes. They started well, but finding the difficulties to be encountered they lost heart, and the committee had a thankless task in trying to get a scheme through without the sympathy of the Council.

DISINFECTING STATIONS.

By HENRY R. KENWOOD, M.B., D.P.H.,

Professor of Public Health, University College, London, and Medical Officer of Health for Stoke Newington.

(Fellow.)

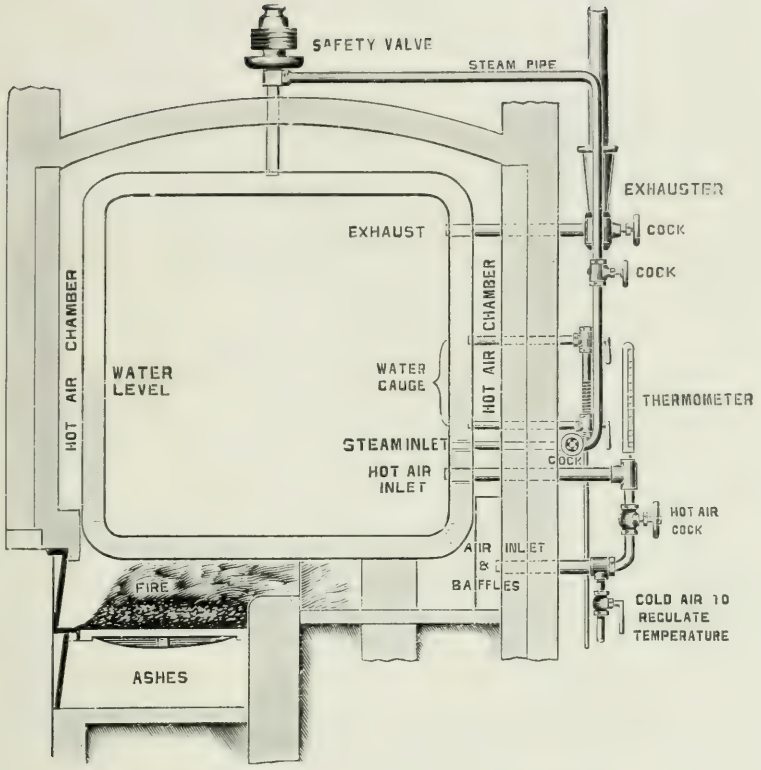
And P. J. WILKINSON, F.R.C.S.E., D.P.H.

(Member.)

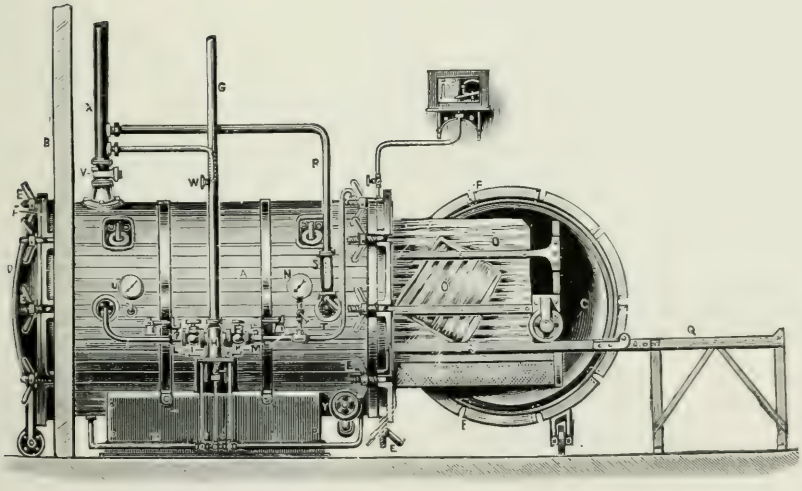
IT is now well recognised that the disinfection of textile articles can be effected by the use of steam, more quickly, more certainly, and with less damage to the article disinfected than by the use of any other agent. It is not judged necessary, therefore, in this paper, to give the experiments of Koch, Wolfhügel, Gaffky, Loeffler and others which prove these facts: but the several ways in which steam has been employed for disinfecting purposes demand some consideration.

As steam penetrates into the interstices of a cold body, it undergoes condensation, and imparts its latent heat instantaneously to the cold objects in contact with it. When thus condensed into water it occupies only a very small fraction (about $\frac{1}{1600}$) of its former volume. To fill the partial vacuum thus formed more steam presses forward, in its turn becoming condensed and yielding up its latent heat, and so on until the whole mass has been penetrated.

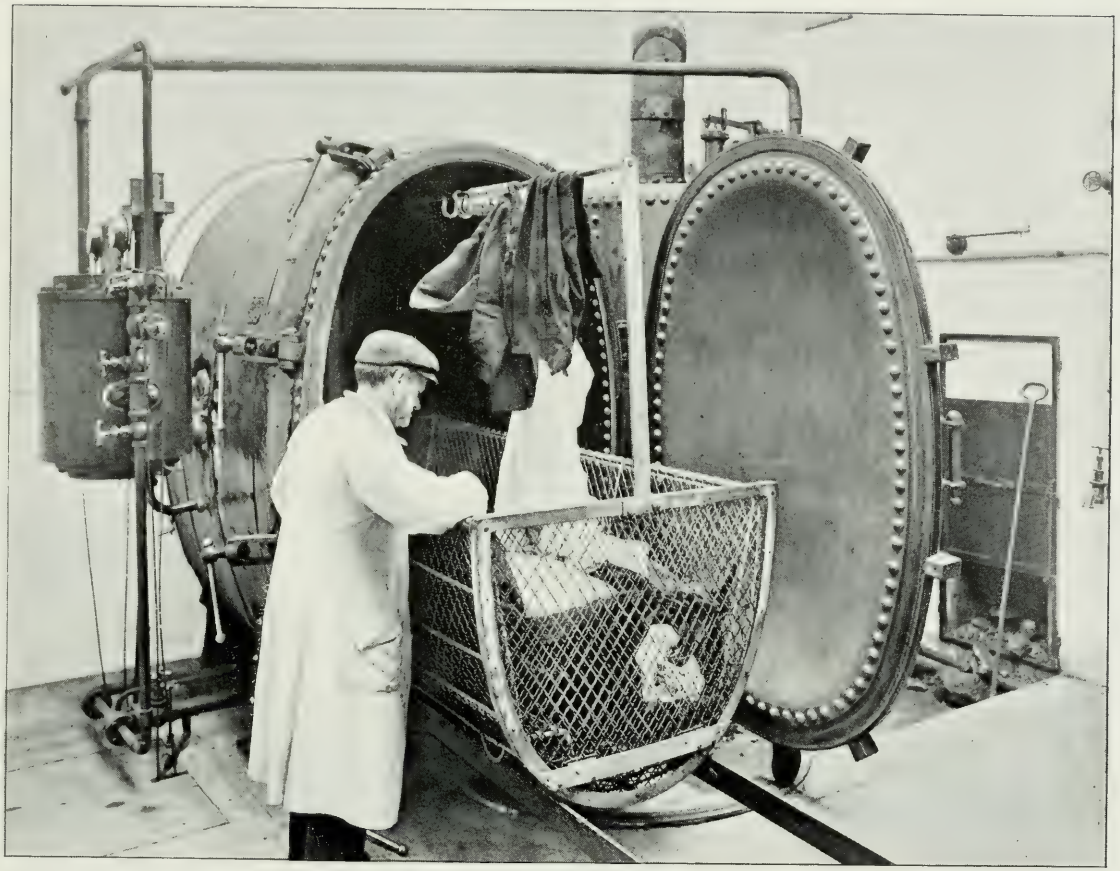
The steam used for disinfecting textile articles should be saturated steam, for the disinfecting value of superheated steam is but little greater than that of hot air, since its penetrating powers are but little superior. Saturated steam is water vapour at a temperature very slightly above that at which it has been generated, and therefore in such a state that it will condense at once upon any article but slightly colder than itself; and the abstraction of the smallest possible amount of heat causes condensation of a portion of the vapour corresponding in quantity to the heat abstracted. If saturated steam is further heated a few degrees, the vapour becomes superheated and thereby partakes more of the physical characters of a gas,



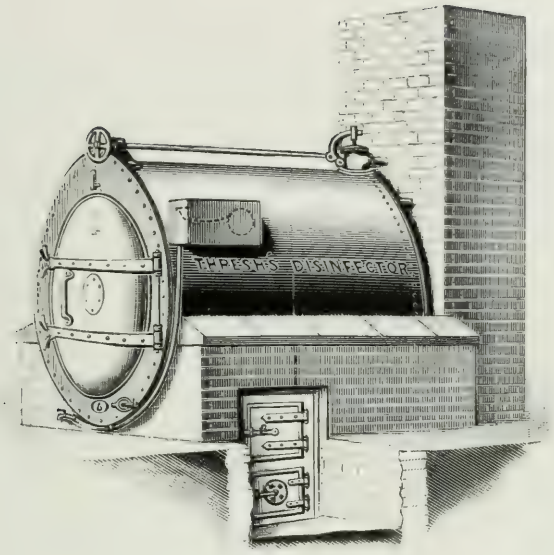
Goddard, Massey and Warner's Disinfector.



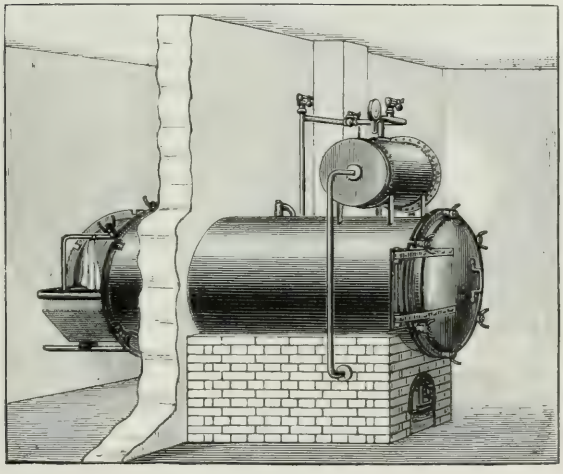
The Equifex Disinfector.



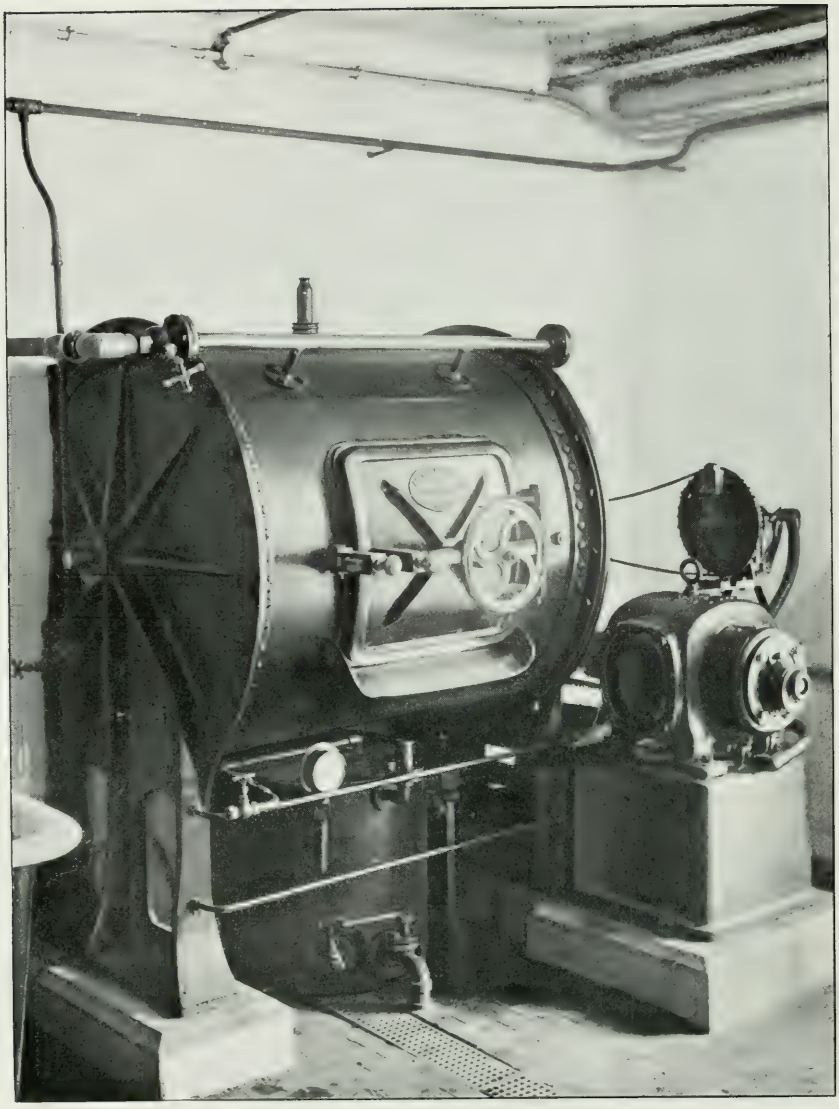
Disinfected articles being removed from the oven at the Chelsea Disinfecting Station.
(The vacuum-producing apparatus is seen on the left of the oven.)



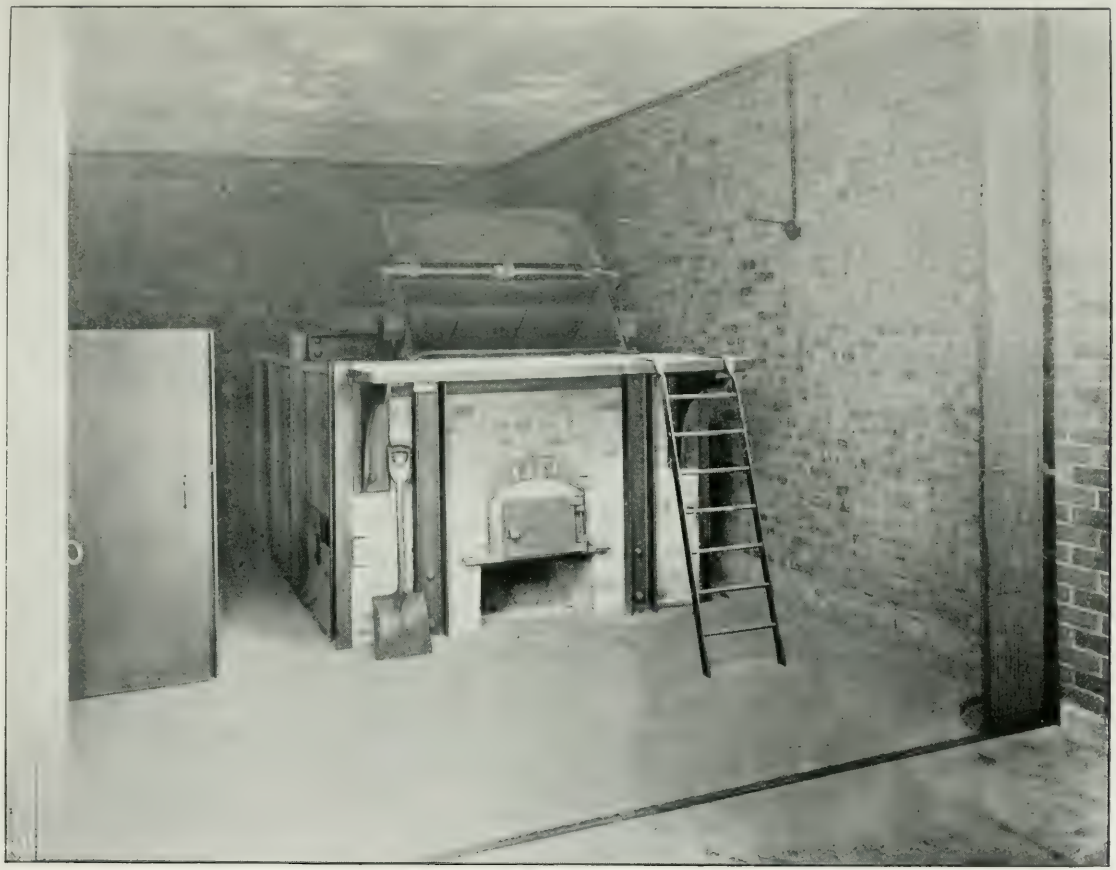
Thresh's Disinfector.



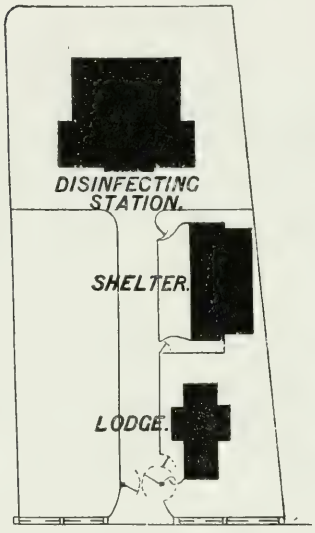
Reck Disinfector.



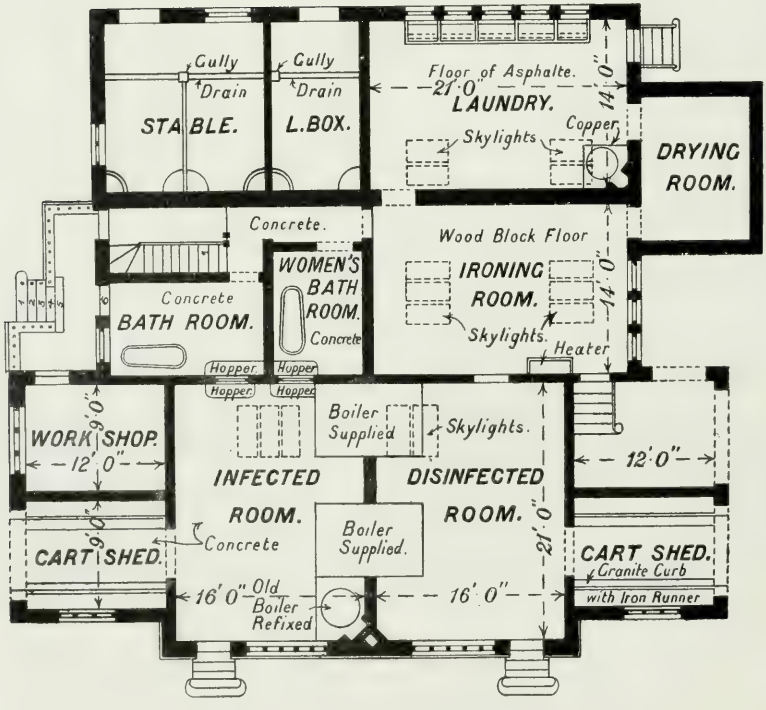
The Rotary Sterilising and Washing Machine.
(Manlove, Alliott & Co.)



Small one-cell Destructor at the Disinfecting Station of the Borough of Chelsea.
(Manlove, Alliott & Co.)

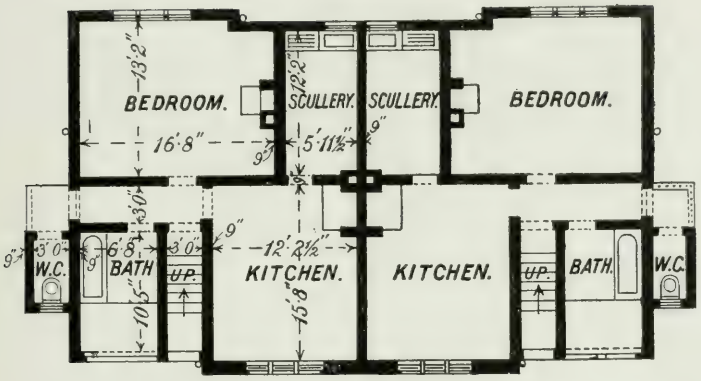


General Plan.

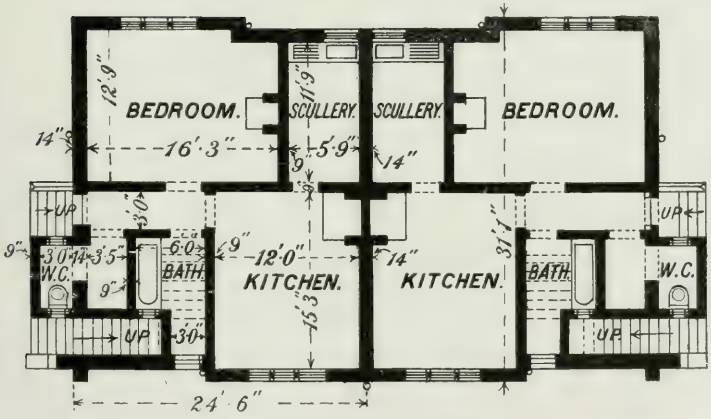


Plan of Disinfecting Station

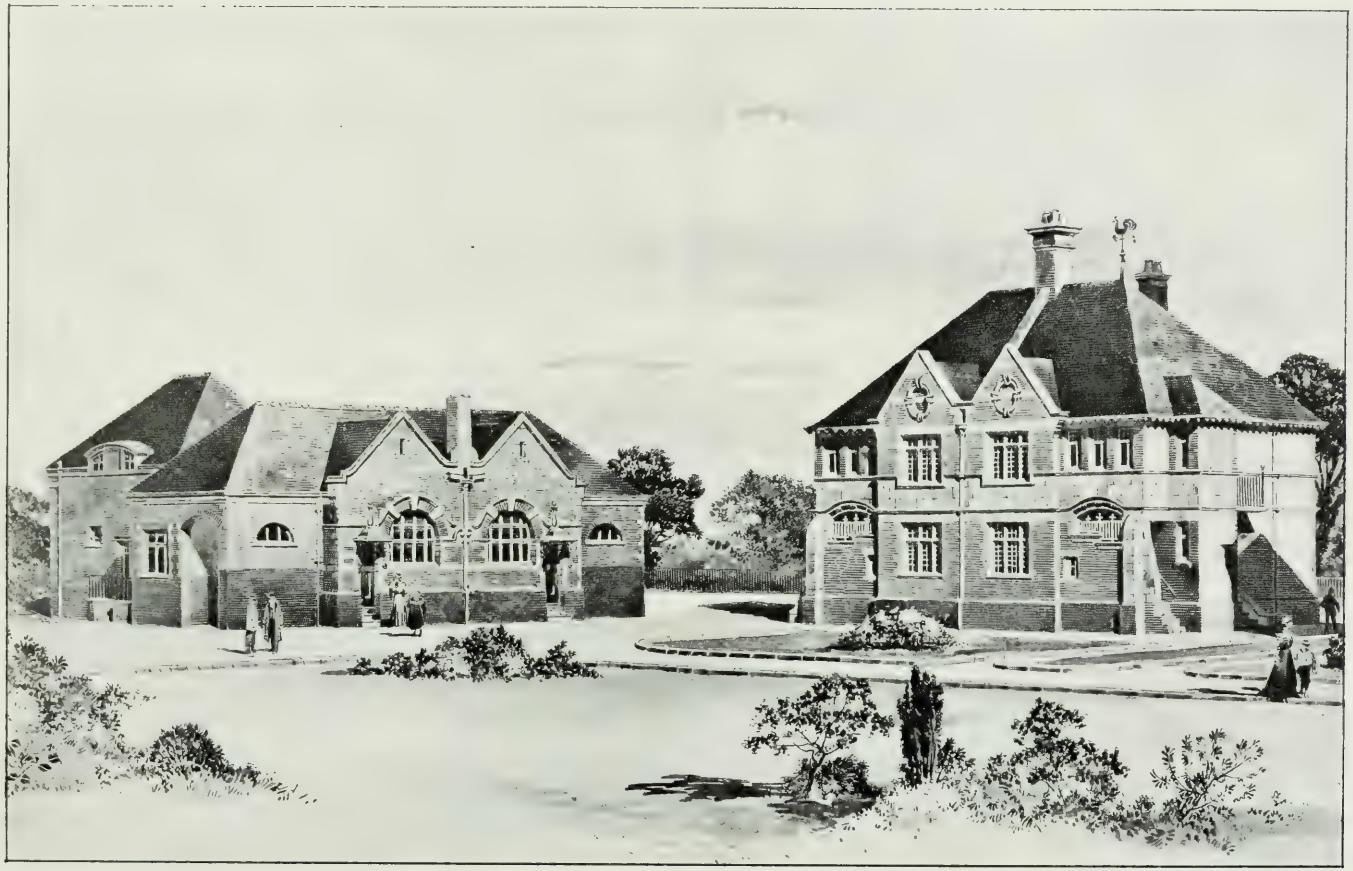
BOROUGH OF HACKNEY.



First Floor of Shelter.

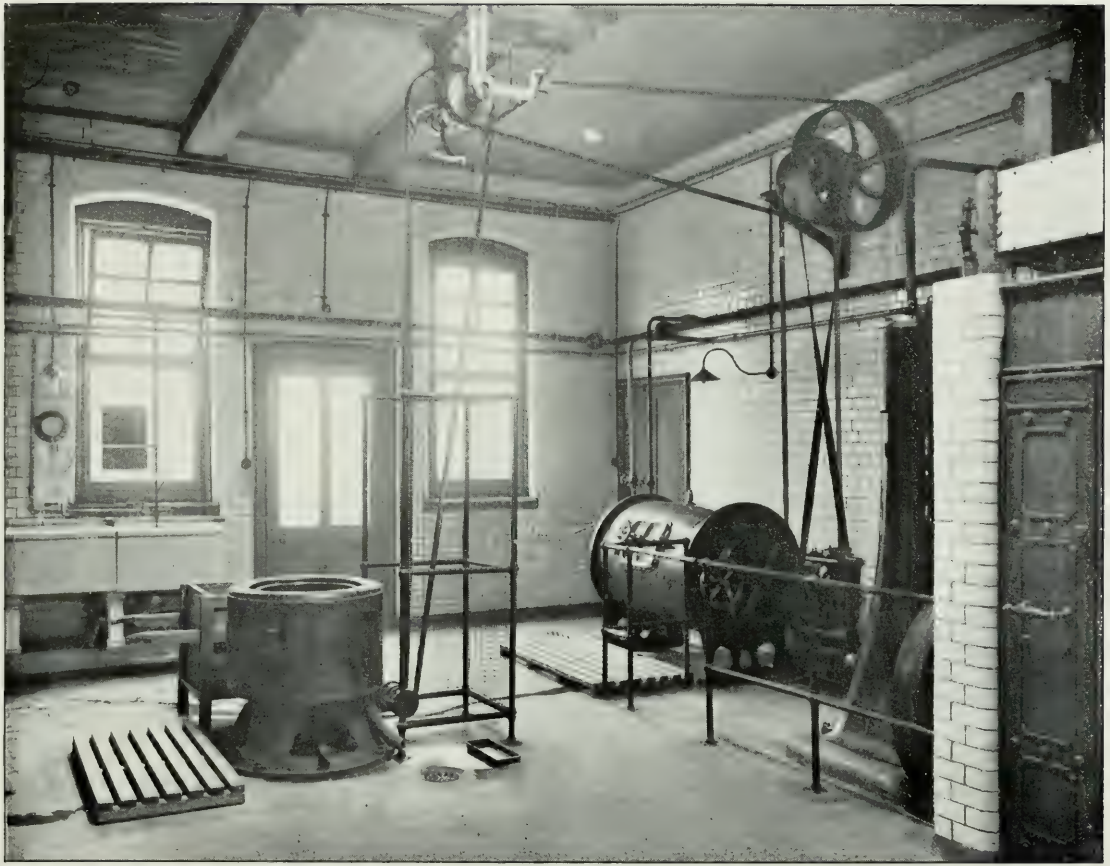


Ground Floor of Shelter.

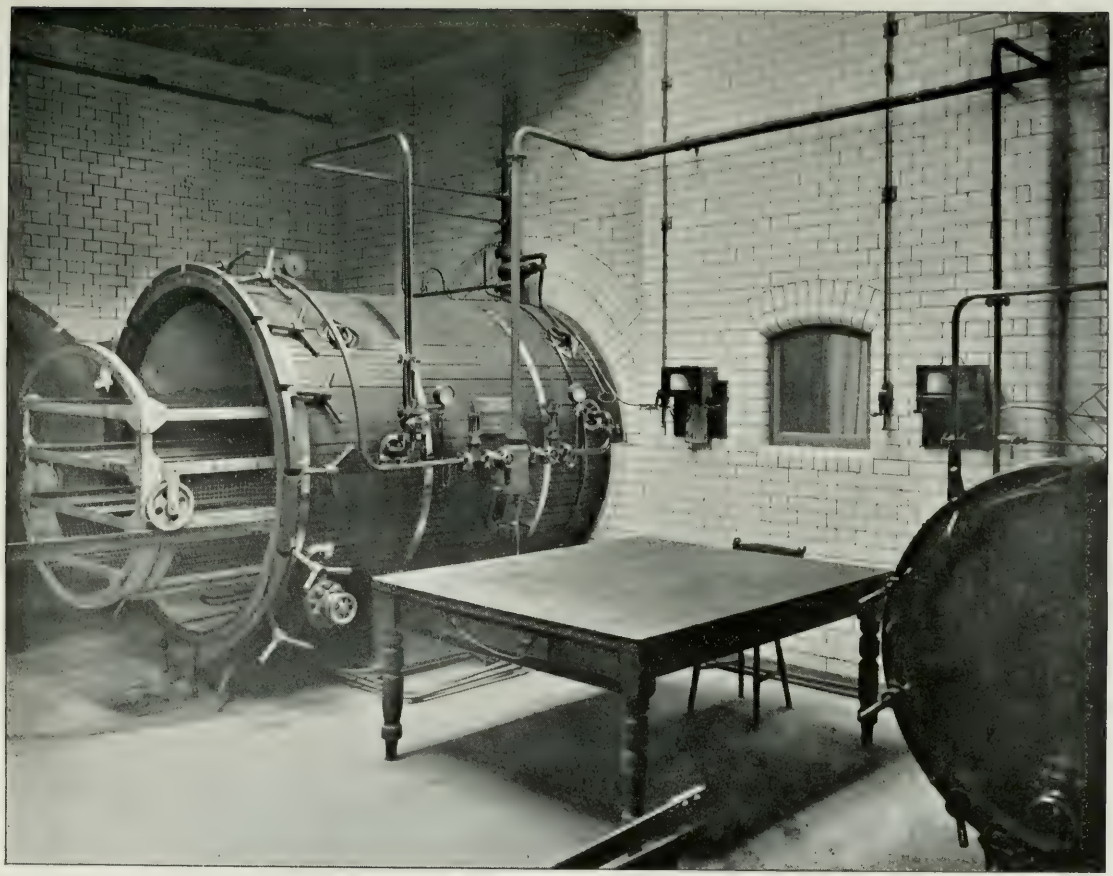


The Shelters and Disinfecting Station of the Borough of Hackney.

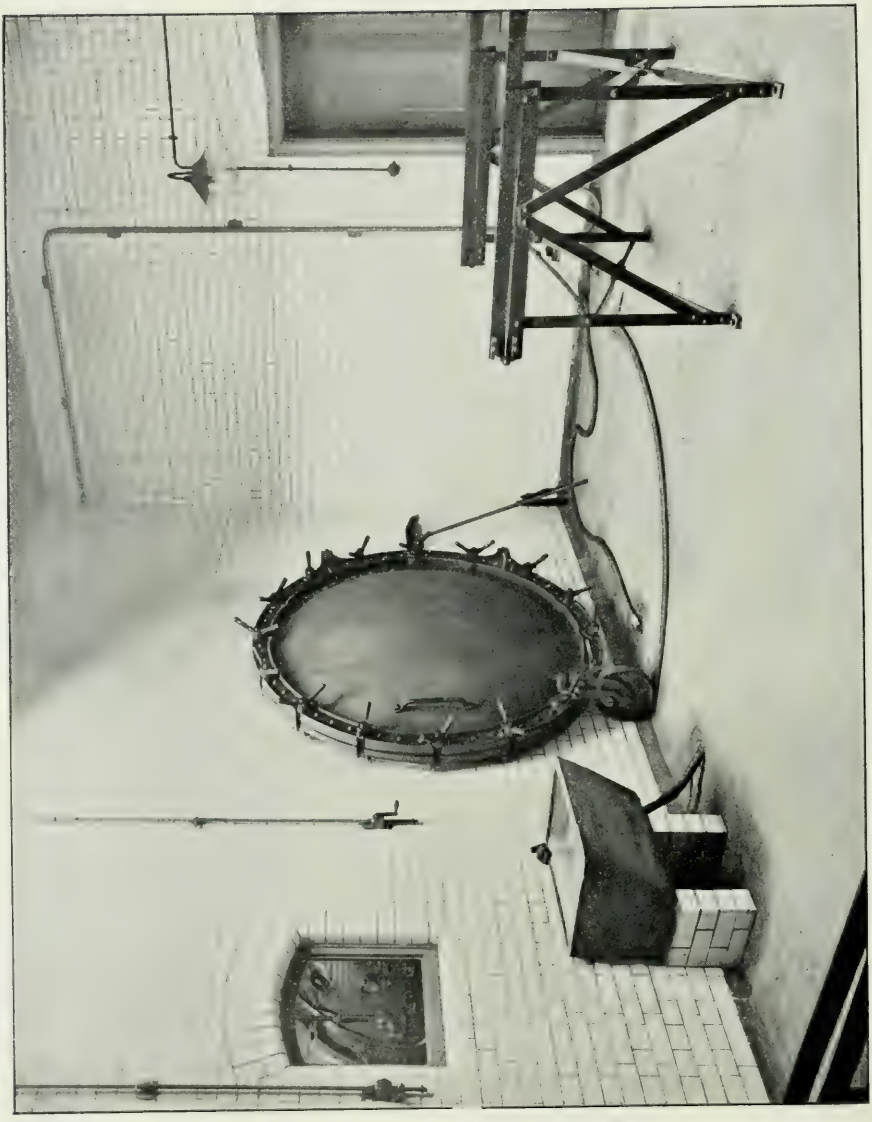
View of a part of the Borough of Fulham Disinfecting Station—showing infected van, the entrance to infected van shed (on left), the exterior of stable, and the top cabin lights.



Interior of the Laundry at the Borough of Fulham Disinfecting Station, showing rotary washer, hydro-extractor, and door of a drying oven on the extreme right.



Interior of non-infected chamber (showing the two ovens) at the Fulham Disinfecting Station.



Interior of infected chamber at the Borough of Fulham Disinfecting Station.

in that it can only be condensed to the liquid form with difficulty. When therefore it is borne in mind that the rapidity and completeness of the penetration of steam into a bulky textile article is almost entirely dependent upon condensation, the advantages of the use of saturated steam are at once apparent.

The use of superheated steam involves a longer exposure in the chamber, and thereby a greater expenditure of fuel, in addition to an increased liability to injure articles. The amount of "superheat," however, which is generally given to the steam in practice is not sufficient to cause it to act very differently from saturated steam.

Saturated steam may be used as current steam at about atmospheric pressure. This steam, under the ordinary conditions of use for disinfecting purposes, is slightly supersaturated; that is to say the vapour contains particles of water in suspension which are the result of the condensation of a portion of the steam itself. Doubtless apparatus using such steam are efficient disinfectors. Professor Delépine testifies to the fact that he has invariably been able to destroy anthrax spores from various sources in less than one minute when a rapid current of steam (free from air) is made to pass over them. The spores of Bacillus Anthracis are generally taken as a standard of the most resistant bacteria capable of infecting man, and there is no reason for believing that the thermal death-point of any human contagion is a higher one, although certain spores, such as, for instance, those of some bacilli found in cultivated soil, are far more resistant.

Steam generated at a pressure of 10 lbs., and therefore at a temperature of 115° C., will generally sterilize soil in a quarter of an hour, but steam at atmospheric pressure, and therefore at a temperature of about 100° C., requires much more prolonged exposure in order to achieve the same results (Esmarch). Hence there is an advantage, in point of time, in the employment of steam-disinfecting apparatus in which the saturated steam is used under pressure, and the higher temperatures are thereby obtained, when very highly resistant organisms have to be destroyed.

If any form of steam-disinfection of bulky textile articles is to be efficient, is is most important that all air should be removed from the apparatus and from the interstices of the article to be disinfected. Gruber's experiments demonstrated (what might well have been surmised on physical grounds) that the destruction of micro-organisms and the rate of heat penetration of a mixture of air and steam, presented no advantages over hot air of a similar temperature. In the presence of air, micro-organisms will certainly survive temperatures which will damage textile articles.

The importance, therefore, of expelling air has led to the adoption of various measures designed to effect this object. Thus, in certain apparatus using steam confined under pressure, the steam is allowed to escape from time to time, as this promotes rapid penetration; the sudden reduction of the pressure causes an expansion of the steam in the interstices of the material under treatment, and vaporization of the moisture contained therein, which displaces the air (otherwise often compressed) in the centre of bulky articles. The greatest effect is of course produced when the steam has been under high pressure. In others a partial vacuum can be created by suitable apparatus after the introduction into the chamber of the article to be disinfected; and Prof. Delépine has demonstrated that when a sufficiently large outlet is provided, the object can be readily effected by the passage of an abundant current of saturated steam through a chamber. The current steam drives out and carries away the air; but doubtless high-pressure steam can be made to effect this with somewhat greater rapidity.

Since saturated steam penetrates largely by reason of its condensation upon the textile articles it disinfects, it necessarily renders them somewhat damp; but if steam is super-saturated it leads to excessive wetting, which, while offering no advantages *qua* disinfection, may cause colours to run and increase the difficulties of subsequent drying. There is no such running of colours when saturated steam is employed, and any apparatus which wets the goods is of an imperfect type.

As to the pressure at which the steam should be employed in high-pressure saturated steam-apparatus in order to get satisfactory results in the shortest time, experimental data are few and somewhat conflicting. A pressure of 10lbs. (temperature 115° C.) is certainly sufficient for all practical purposes, although, as would be expected, there is evidence that a pressure of some 20lbs. is slightly more expeditious in its work.

The time required for disinfection by steam obviously depends on the resistance of the organism to be destroyed, the bulk of the infected articles, and the pressure of the steam employed. The best researches indicate a temperature of 115° to 120° C. for twenty minutes, as trustworthy in all cases.

Doubtless pathogenic bacteria can be sufficiently rapidly killed for all practical purposes by a rapid current of saturated steam at current pressure; and since such apparatus are cheaper, of simpler construction, and easier to work, they will often be preferred. For smaller installations, in which relatively little work has to be done and where an unskilled individual is asked to perform it, they are to be recommended.

The size and shape of disinfecting ovens are made to suit all requirements. Generally speaking, it is a mistake to fix an oven of less dimensions than from 6 ft. 6 in. to 7 ft. in length and from 4 ft. 6 in. to 5 ft. in height. The oval or elliptical and the rectangular shapes are most frequently adopted, although it would appear that the circular form is the best from a mechanical or structural point of view. Articles, such as mattresses, pack best in the rectangular shape.

Usually the body of the machine alone is jacketed, and the doors are properly lagged with non-conducting material. Under these circumstances there is no trouble from steam-condensation upon the door; but some makers steam-jacket the doors as well.

The rapidity of the penetration of heat into articles is ascertained by placing within them a thermometer which on registering the required temperature rings a bell, by reason of the mercury completing the circuit of an electric current from a battery. The efficiency of the provision for drying the articles is gauged by the amount of moisture remaining in them after removal from the stove, as calculated by the increase in weight of the article. The maximum temperature reached in the stove and the uniform distribution of the heat may be tested by means of recently standardised maximum thermometers wrapped up in blankets and exposed in the stove; and the pressure within the stove can be ascertained at any time by the pressure-gauge.

There are three methods of supplying the steam to the oven:

(1) The steam may be conducted from an existing boiler working at a convenient distance. This is a cheap method, and it possesses the further advantage that the process of disinfection can be put into operation without any loss of time at any hour of the day.

(2) The steam may be generated in a small special boiler. Such a boiler is sometimes made to supply steam for washing-purposes.

(3) The lower part of the jacket of the oven may be filled with water, and by firing directly under the machine, steam may be raised in the jacket of the disinfector itself. This arrangement favours compactness and economy, but a separate boiler is more accessible for cleansing and repairs.

Where the water supply is hard there is a great advantage in making arrangements for softening the water before it is allowed to enter the boiler; more especially is this of importance when laundry work is done upon the premises, and when an apparatus is used in which the jacket of the oven is made to serve as the boiler.

The various stoves now employed for disinfecting by steam may be classified as follows :—

1. Stoves in which steam without pressure is employed. These are of course cheaper, but, generally speaking, those upon the market are less efficient than—

2. Those in which steam at low pressure (2, 3, or 5 pounds per square inch) is used. Although the temperature of 110° C., which can be reached by some of these stoves, is generally sufficient, a higher temperature can never be employed in them. These stoves, though cheaper, meet with less acceptance in this country than—

3. Those in which steam at high pressure (10 lbs. and over) can be employed. A temperature of 115° C. to 120° C. can be obtained in these stoves ; and an exposure of articles for about twenty minutes will suffice for their disinfection.

We will now proceed to a brief description of the forms of stoves mostly used in this country at the present day. In the high-pressure *steam disinfector of Messrs. Goddard, Massey & Warner*, of Nottingham (p. 117), the oven is rectangular, with steam-jacketed doors, and the lower part of the jacket of the oven serves as the boiler. There is also a chamber for heating air, and by means of an exhauster a strong current of hot air can be made to pass through the oven. By means of this hot air the articles are warmed prior to the admission of steam, and after disinfection the current of hot air is made to carry away the steam and to dry the articles.

The method of working the apparatus is as follows :—A fire is lighted and the closet filled with the articles to be disinfected. The doors are closed and screwed up, making a perfectly steam-tight joint. In the meantime steam has risen to 20 lbs. pressure per square inch on the boiler, blowing off at the dead weight safety valve. This latter is of such a size that the steam cannot rise above 20lbs. pressure, thus preventing any damage which could occur through inattention. The exhauster is now set to work by opening the valve and steam supply, causing a current of hot air to pass through the valve into the closet, thus thoroughly warming the articles.

After this operation has continued for some little time the valves are closed. The steam is then admitted to the closet by another valve, and in about two minutes the pressures in the closet and boiler are the same, as shown on the gauges. The pressure is then increased until it blows off at the safety valve. The articles are left in the closet for twenty minutes. Then the valve is closed and the valve to the exhauster opened ; this

operation allows the steam in the closet to escape, the pressure soon falling to zero. The valves are again opened and hot air passed through the closet, displacing any steam in it which would condense on the articles when the door is opened, and also thoroughly drying the articles that have been disinfected. In a few minutes the door may be opened, the valves closed, and the disinfected articles taken out on the opposite side of the apparatus to which they are put in. The stove can also be supplied with a separate detached boiler if this is preferred.

Messrs. Goddard, Massey & Warner are also the licensees and manufacturers of Washington Lyon's steam disinfector, which is oval in shape, has a separate detached boiler and a non-jacketed door, and in which the steam in the oven is slightly superheated by the greater heat of the steam in the jacket.

The high-pressure *steam disinfector of Messrs. Manlove, Alliott & Co.*, of Nottingham (p. 118). This disinfector, made under the patents of Mr. Washington Lyon, is a steam-jacketed chamber, and the steam in the jacket is employed at a pressure and temperature distinctly higher than that employed in the chamber itself. The steam is thus somewhat superheated. The air is removed from the chamber and from the interstices of the articles by means of a vacuum-producing apparatus or air-pump, which is also utilised to produce a current of hot air through the oven after disinfection, and thus to remove the steam and dry the articles disinfected. The use of steam for heating the entering current of air ensures a necessary control of temperature, since the temperature of the air cannot at any time be raised above that of the steam.

On exhausting the chamber the reduction in pressure from steam at 20 lbs. per square inch above atmospheric pressure to a pressure considerably below that of the atmosphere, is accompanied by a corresponding fall in the temperature at which water changes into vapour, with the result that any moisture or dew which may have been either introduced with the articles to be disinfected or condensed from the steam used for disinfection, is at once evaporated by the heat stored both in the particles of moisture and in the substance of the goods. This action in itself is practically sufficient to ensure dryness.

The machine can, when desired, be used as a simple hot air oven heated by steam, but without any steam in the disinfecting chamber, and it may be used in this way for disinfecting furs, leather, and other animal substances that may be injured by the application of steam. The use of the vacuum favours the rapid penetration of the hot air and the disinfection of the articles in a short time.

The *Equifex Saturated Steam Disinfector* (p. 117) is worked with saturated steam at 10 lbs. pressure (115° C.). The chamber is non-jacketed, and its walls are lagged with non-conducting composition and wood. The doors are provided with runner wheels and floor rails to facilitate opening and closing, and an internal wheeled carriage for the clothing, etc., runs on internal rails and hinged outside rails. An ingenious automatic recording gauge with a diagram-card on a clockwork revolving drum is provided with the disinfector. The card is marked by a pen actuated by the variations of pressure which, owing to the steam being saturated, corresponds to and accurately indicates temperature in accordance with Regnault's law.

Condensation upon the walls of the cylinder is prevented by an arrangement of coils containing steam at high pressure; and the articles are subsequently dried by hot air. By admitting steam first of all to the coils the chamber is warmed before the infected articles are introduced, then valve **T** is opened and steam admitted to the chamber by valve **I**. When the thermometer **S** registers 96° C., close valve **T**, and, the air being then ejected, the pressure will rapidly rise to 10 lbs. (115° C.), which will be registered on the automatic recording gauge. At the end of five minutes close valve **I**, open valve **V**, and close so soon as pressure on gauge **U** has fallen nearly to zero, thus re-evaporating the moisture condensed on the objects, and ejecting with the steam any air remaining in the pores of the articles. Repeat this discharge of steam at the end of the second and third intervals of five minutes, thus giving a total exposure of fifteen minutes net to saturated steam at 10 lbs. pressure. In the last case open also valves **W** and **Y**, thus allowing air to be sucked in over steam-heated pipes, and to carry off the last traces of moisture. An ordinary mattress will be dried in from five to twelve minutes, and thicker objects with corresponding rapidity.

Thresh's Disinfector (p. 119).—In this apparatus steam without pressure at a temperature of about 106° C. is employed, the superheat being obtained by using in the boiler a calcium chloride solution, the boiling point of which is considerably above that of water. The lower part of the jacket of the cylinder contains the saline solution, and acts as the boiler, which is heated by a small furnace, and the steam which enters the chamber escapes continuously through a chimney. As the water of the boiling solution evaporates, an equivalent amount is introduced automatically from a small cistern with a ball-valve arrangement. When the steam has passed for a sufficient length of time the raising of a lever cuts off all communication with the inner chamber, and the steam escapes directly

into the open air. Then, upon opening the aperture below the door of the inner chamber, air is drawn through a coil of tubes surrounded by the boiling liquid, becomes heated, traverses the inner chamber, displaces the steam, and dries the articles contained therein. It is claimed that at the expiration of an hour from the commencement of the operation, the bedding, etc., may be removed, as disinfection is then complete, and that the articles will be found to be as dry as when introduced.

Where a steam boiler already exists for other purposes the steam from it can be used for heating purposes; this is done by passing the pressure steam from the boiler through a coil fitted in the jacket, in which is the solution to be heated. The apparatus is of simple construction and easy to work, and it is one of the cheapest upon the market.

Reck's Apparatus (p. 119) is a cylinder three feet in diameter and seven feet long, with the following special features: (*a*) the use of low pressure steam at 104° C. to 106° C. delivered to the apparatus by an automatic regulator at a rate which cannot be exceeded, (*b*) the absence of any steam jacket, and (*c*) an arrangement by which a cold water shower can be turned into the chamber, with the object of removing all steam from the interior in the shortest possible time after the process of disinfection is completed. As regards the cold shower, it is introduced at the top of the apparatus and falls on to an umbrella-plate spread over the upper part of the hot chamber, and which distributes the stream over a large surface and conducts the water to the floor of the chamber, where it escapes in such a manner that it does not come in contact with the articles which are being disinfected. The result of the sudden introduction of the cold shower is a rapid cooling and condensation of all live steam in the chamber, the vacuum produced being automatically replaced by air entering through a valve in front of the apparatus as fast as the steam is condensed and carried away by the cold water.

The steam goes through the disinfector into an opening in its top and the exhaust outlet is in the bottom. The current of steam is not interrupted when the air has been expelled, but is allowed to go on the whole time, thus gradually removing all traces of air from the interstices of the articles.

The arrangements for drying consists in a simple water jacket that surrounds most parts of the disinfector. During the steaming process the water in the jacket is heated to the same temperature as the interior. When the process of disinfection is completed, air is allowed to pass through the disinfector, and the water jacket gives off heat enough for drying the articles completely before they are taken out.

The disinfectors are for ordinary work built for $1\frac{1}{2}$ pounds pressure, but they can be supplied if desired for use with a higher pressure, and capable of completing the disinfecting process in a still shorter time.

The cost of the different apparatus above described varies of course with the size, and as to whether the steam used is pressure steam or not. The apparatus employing steam under pressure differ very little as to cost; those with chambers from 6 ft. 6 in. to 7 ft. long and of a height of from 4 ft. 6 in. to 5 ft. cost from £260 to £270, exclusive of the cost of setting; but Thresh's apparatus for current steam, and Reck's apparatus of similar dimensions, may be purchased for half these amounts.

A disinfecting station should comprise:

1. Two rooms completely separated from each other by a wall into which the stove is built so that it communicates with both rooms. The infected articles are brought into one room and placed in the stove, and after disinfection they are removed from the other end of the stove, which opens into the non-infected room. No infectious material must be allowed to enter the non-infected room, and there should be no direct means of communication between it and the infected room. The floors and walls of both rooms should be made of some smooth and non-porous material, which can be readily and efficiently cleansed by water; and exceptionally good provision should be made for ventilation and light. If good ventilation is not provided the rooms become very hot in the summer time, and it is a good plan, in order to reduce the heat and to protect the articles from dust and smoke, to arrange that the stoke-hole and coal-store are outside the compartments when the furnace is immediately under the disinfecting oven, and even when the boiler is separate the stoke-hole and coal-store should be placed in a small compartment, shut off from the working rooms.

2. An incinerator and destructor, provided with a small second fire to cremate the products of imperfect combustion before they pass up the flue.

3. Separate sheds for (*a*) vans employed to bring in infected articles, and (*b*) those employed to return the disinfected articles.

4. A laundry and bathroom should also form part of a disinfecting station, and a charge may be made for any laundry work undertaken after the disinfection of infected articles.

The Disinfecting Station proper.—The walls should be lined with glazed brick or tiles, carefully jointed, or with some other hard, smooth, and non-porous material; and there should be as few angles as possible to harbour dirt. The floors should be laid in concrete, grouted over to a

smooth surface with cement, and with ample provision for drainage. The rooms for infected and disinfected articles, respectively, should be so arranged that direct communication is impossible, and the doors of these rooms should be placed at the extreme ends of the building.

The *Rotary Sterilizing and Washing Machine of Manlove & Alliott* (p. 120), is designed to meet the difficulty that has been experienced in most hospitals and kindred institutions, in dealing with linen that has been soiled by one or more of the many forms of animal matter.

It is a matter of common knowledge that such soiling will often be fixed by the ordinary methods of washing in a laundry. Moreover, such washing is sometimes preceded by steeping in a disinfecting fluid which leads to much objectionable handling. In the rotary sterilizer, such articles can be thoroughly cleaned and disinfected by saturated steam with a minimum of handling and without leaving any stains. As the sterilizer is composed entirely of metal, there is no chance of the vessel becoming foul and odorous; and its construction is such that disinfection may be effected by saturated steam at 112° C. It is fitted with two doors and built into a cross wall, so that purified and disinfected goods may be discharged from the machine after treatment into a separate room, where there is no chance of their coming into contact with infected and untreated articles. As some of the liquor discharged from the sterilizer might be of a highly-infectious nature, the precaution is taken of boiling it in a separate vessel prior to allowing it to escape into the drains.

The Illustration is from a photograph taken on the infected side.

The mode of driving the sterilizer is, of course, quite optional. In the installation illustrated, electricity was preferred, and the little driving motor may be seen on the right side of the picture.

Staff.—The disinfecting staff should always be provided with overalls, and caps or handkerchiefs for the head. An ideal arrangement would be for the worker on the infected side to entirely change his clothes in an adjoining room before commencing work, and a bath should be taken before leaving the premises.

The person in charge of a disinfecting station must always bear in mind that certain materials are injured by steam disinfection. Flannel and woollen goods may shrink somewhat and become discoloured unless a suitable steam disinfecting apparatus is properly worked; but kid and leather articles are shrunk so much that they are spoiled, and feathers and furs are rendered hard and dry. Books, moreover, must not be placed in such an apparatus.

It is necessary, therefore, to make some special provision for separately

disinfecting the articles which are injured by steam disinfection. For books, we know of no better provision than an air-tight cabinet, provided with a tightly-fitting door, and with a cubical capacity of some 100 cubic feet. The cabinet is provided with wire shelves on which the books may rest. The books are so arranged that their leaves open out fanwise, so that when a lamp (placed on the floor of the compartment) is made to generate some 2 per cent. of formic aldehyde into the atmosphere of the cabinet, the disinfecting vapour can get between the pages. Fortunately, books have little tendency to retain infection, and the above method has proved quite efficient after many years of practice.

Leather-goods, furs, and feathers are often treated in the oven by means of hot air, steam being excluded. This method cannot, however, be relied upon to disinfect, and a preferable means is to spray them copiously with either 1-in-500 perchloride of mercury solution or with 2 per cent. formic aldehyde solution, to allow the articles to dry slowly, and then to respray them.

Collection and delivery of articles.—Separate vans should be used for the infected and clean articles, and these should have distinctive colorings; as by picking out with red the infected van, and the van delivering the clean load with white. They should be zinc-lined, and constructed internally so as easily to be cleaned. Such vans cost from £50 to £60 each. The vanmen should have books with duplicate lists of the articles removed, which list should be initialed by the owner on collection and after delivery.

The system of collecting the smaller articles in canvas bags, which can be put direct into the oven, is generally adopted. By this arrangement, the risk of articles belonging to different premises being mixed at the station is almost removed, but separate parcels must always be made of articles which are damaged by steam disinfection. It is a good plan to place coloured fabrics in bags separate from the white articles; and if each article is carefully folded up and packed in the bag, the articles are not so badly creased as is otherwise often the case.

Laundry.—To many modern installations laundries are attached, and it is a distinct advantage in minimizing the risk of infection. As steam or electric power is always available the machines may be driven by either. There should be a rotary washer, hydro-extractor, washing troughs, rinsing and blueing troughs, all supplied with steam or hot water. In addition ironing and sorting tables, mangler, drying ovens, etc., should be provided.

The laundry is also serviceable for the use of the shelter, when this provision is also made, as it commonly is, in the immediate neighbourhood of the disinfecting station.

Shelters.—The need of shelter accommodation for persons who are compelled to vacate their houses whilst the premises are being disinfected is far greater than might be supposed from the use generally made of this provision. The Public Health (London) Act, 1891 (section 60, sub-section 4), enacts that: "The Sanitary Authority shall provide, free of charge, temporary shelter or house accommodation, with any necessary attendants, for the members of any family in which any dangerous infectious disease has appeared, and who have been compelled to leave their dwellings for the purpose of enabling such dwellings to be disinfected by the Sanitary Authority."

The shelter should be made as pleasant and cheerful as possible in order to meet the prejudice which persons entertain against entering it. It should contain a large bedroom, containing one large bedstead and a second smaller one, kitchen, scullery, w.c., and bathroom for each family accommodated; and a sufficient supply of bedding, cooking utensils, crockery, etc., should be provided. Usually a fixed sum of money is allowed per occupant per day in cases where they are too poor to purchase their own food.

Destructor.—It is so frequently found necessary to destroy infected articles that for this purpose a suitable destructor is essential in connection with every disinfecting station. In several of the Boroughs of London (Hackney, Fulham, &c.) the refuse-destructors are close to the disinfecting station so that infected articles to be destroyed can be dealt with there. If, however, the destructor is at a distance, suitably constructed receptacles may be used for the conveyance of infected material.

In connection with the Chelsea Disinfecting Station, there is a small *one cell* destructor (Sergeant's patent) constructed by Messrs. Manlove and Alliott (p. 121). It works efficiently, and at a very small cost, and is found sufficient for the needs of the Borough. Similar destructors are also made by several other firms.

Messrs. Goddard, Massey & Warner, of Nottingham, make a combined apparatus for burning infected rubbish and for disinfecting articles. In this apparatus the heated products from the combustion of the burning refuse are made to assist the process of the disinfection of textile articles by steam.

The construction of the combined furnace and steam disinfector, in accordance with this invention, has a flue passing out of the furnace and carried forward into a brick chamber which is constructed to partly surround the steam disinfector, by this means the heat contained in the products of combustion from the refuse is brought to bear upon the outside

shell of the steam disinfector, thus utilizing the heat by generating steam and also forming a warm jacket to the disinfector.

When the refuse is not sufficient to produce all the steam and heat needed for disinfection ordinary fuel may be fed upon the fire grate. The steam produced may also be used to sterilize excrementitious matter or sewage from infectious hospitals.

The position of the station will often, for various reasons, leave something to be desired, but in selecting the best available site due regard should be paid to accessibility from all parts of the district served, and to the sufficiency of the area as to size.

As to the total cost of a properly equipped disinfecting station, exclusive of shelters and the cost of the land, and designed to do the work for a population of 100,000, the amount will generally fall between £3,000 and £4,000, and the annual working expenses will not fall short of £1,000.

One of the most recent and best equipped installations in the metropolis is that of the Hackney Borough Council, regarding which we give the following notes:—Erected in 1901, site over three acres. *The Station* (see plans, pp. 122–124) occupies an area of about 4,000 square feet, including laundry, cart sheds, workshop, stables, bathroom, &c.

The rooms receiving the infected articles and the disinfected articles are each 16 × 21 × 18 feet; walls white glazed bricks; floors concrete; top cabin lights which open for ventilation; electric lighting. Infected and disinfected rooms quite separated, entrances being thirty feet apart. Dividing wall has glass windows.

Contains two Manlove & Alliott full-size machines, fitted with vacuum apparatus, sorting tables and racks.

The sheds for the infected and non-infected vans have entrances to the infected and non-infected rooms respectively, and are placed at the extreme ends of the building. For the purpose of cleansing of verminous persons, and dealing with clothing worn by verminous persons, two *hoppers*, with locking arrangements on either side, are constructed in the wall of the infected room. There are separate bathrooms for women and men, and the verminous clothing is passed through the hoppers to the infected room, where it is introduced into the oven.

All articles are collected and returned in separate bundles. Printed lists of articles given on receipt and delivery.

Staff: One foreman disinfector and assistant, two vanmen.

Vans: Zinc-lined, and infected van picked out in red, disinfected van picked out in white. Disinfectors wear overalls and take a bath before leaving work.

Laundry: 28×22×18 feet, contains 1 washing machine; 1 mangler; 1 hydro-extractor; a drying-room; washing and bluing troughs, made of glazed stoneware; ironing tables, with irons heated by electricity.

Machinery is driven by electricity.

Stables are provided for two horses for the vans, together with a loose box for a sick horse.

Shelters (see plan), very handsomely constructed in red brick; consist of four tenements. Each has a large bedroom, kitchen, scullery, bathroom, and w.c., and is well furnished and equipped. In 1903, 159 persons were accommodated for varying periods.

The total cost of land (3 acres), buildings, and all apparatus was about £10,000.

Views of the Disinfecting Station for the Borough of Fulham are given on pages 125–128.

HYGIENE IN SCHOOLS.

By F. BUSHNELL, M.D., D.P.H.
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SIR JOHN SIMON'S ideal education would "by model and example lead the poorer classes of society to know cleanliness from dirt, . . . and would apply their instincts of self-preservation to the deliberate avoidance of disease."

Charles Kingsley believed that "teaching of this kind ought to and will be held a necessary element in the school course of every child, just as necessary as reading, writing, and arithmetic." To this most of us would say, "Yes, and even more necessary."

The first question to be answered is: "What are the opportunities afforded in elementary schools for instruction in practical hygiene?"

In 1900 the "block grant" system was introduced into the annual code of the Ministry of Education. All schools must take certain subjects, including "Lessons on Common Things," with a list of additional subjects, one or more of which must be taken when H.M Inspector thinks it is desirable. In this list are hygiene, animal physiology, domestic economy, elementary physics, and chemistry. Besides this, special grants are paid for cookery, laundry-work, dairy-work, and household-management. The instruction in all subjects is to be in accordance with a syllabus which must be produced to the Inspector at his visit. Under Article 16 any other subject may be introduced if approved by the Inspector. In 1889, of five and a half million boys, girls, and infants on the rolls, 2 per cent. were taking domestic economy (mainly girls) and 1 per cent. (mainly boys) animal physiology. This, I think, shows the ample opportunities that exist and the slight advantage that is taken of instruction in hygiene. However, the Leicester and Bradford School Boards and Dr. Hall at the Leeds Schools have carried out with success a scheme of hygiene-teaching, and in the West of England some action has ensued.

The second question that arises is: "What powers exist to supervise and improve the health of scholars and the conditions under which their school life is spent?"

The Department of Education has confined itself in its codes mainly to regulations intended to ensure the physical well-being of children; it has drawn up building-rules (which are often disregarded, I understand); it

has authorised restrictions to exclude children or to close schools during epidemics; it has also issued a model course of physical training, and such training has been definitely approved by the Prime Minister. The Local Government Board issues a memorandum on epidemic sickness; it and the code of rules of the Medical Officers of Schools Association should be familiar to all teachers. Separate schools for children of imperfect intellect have been provided, and special grants are paid to their maintenance. An important step in advance is the appointment in some places of medical officers to the schools of education-authorities. Dr. Kerr's first report to the London School Board, June, 1903, and the excellent observations made on the pupils of the King Alfred School, Ellerdale Road, Hampstead, are worth perusal. The weights and measurements of children, the supply of adequate food, cleanliness of person, soundness of teeth, freedom from disease of the nose, ears, eyes, throat, skin, etc., can thus be observed and dealt with systematically. Such statistics would soon be a record of very great value of the national physical conditions.

The third question of import is: "What inducements are held out to teachers to train themselves and impart such knowledge as we advocate to children?"

It is obvious that, granted even the full approval of the Education Authority, it is indispensable that the lecturer be animated by absolute conviction of the truth and relative worth of such knowledge, which, as the late Mr. Herbert Spencer truly said, is the most momentous question in deciding on a code of education.

Teachers are regarded as fully qualified after passing the certificate examination, either as acting teachers or after residence or attendance at a Training College. The syllabus for the 1903 examination for acting teachers (who continue their work in schools while reading for their examinations) included under "school method" certain points in school-hygiene of the utmost importance. However, no knowledge of the elements of animal physiology is asked for. Training Colleges have the power of drawing up their own schemes of study, and undoubtedly should insist on such instruction in their curriculum. This may be given in the evening continuation classes under "Knowledge of common things," and "Life and duties of a citizen." As you may know, the British Association appointed a Committee in 1902 to report "on the conditions of health essential to the carrying on of the work of instruction in schools." This Committee advised that the Education Department should (1) "adopt or recognise some more thorough and practical test of a teacher's knowledge and experience of the application of health conditions in school

life"; and (2) should further "protect health in school life by making practical knowledge of hygiene as applied to school life an essential qualification for those to whom it entrusts its school inspection."

Finally we should determine what we consider as all important for embodiment in our national systems of education. Before doing so I may here remind you what health conditions the British Association considered imperative in school life :—

(1) Bodily nourishment;
(2) Clothing;
(3) Housing of children in schools;
(4) The working of the bodily functions and organs of sense;
(5) Physical exercise;
(6) The appointment of time to work and rest, including length of lessons and holidays;
(7) Healthy tone of mind and morals;
(8) Preventive and precautionary measures against infectious diseases.

Then, too, the eleven recommendations of the Royal Commissioners appointed in 1902 to inquire into and recommend upon physical training (Scotland) are worth your close attention (*Brit. Med. Jour.*, April 4th, 1903, summary). They dwelt upon the health-methods to be adopted for improvement in schools, universities, and continuation-classes, for feeble-minded and cripples, and advice was given on medical and general inspection, on feeding, system in teaching, training of teachers, and the value of auxiliary agencies.

The views of Miss A. Ravenhill are widely accepted and can be read in the Journal of The Sanitary Institute, July, 1899, and April, 1902, the latter containing an account of school-hygiene in the U.S.A. Miss Ravenhill recommends that systematic practical lessons in hygiene should be continuously given in the seven standards in elementary schools, to be characterised by simplicity of treatment and a natural development from certain essential principles, and to be suited for both sexes.

In Standard I. the attention is to be directed year by year to the essentials of a healthy, happy home, its comforts and conveniences, such as light, air, space, cleanliness, surroundings, repairs, rent, and fittings; some outline of the protection afforded to all by the public health laws is to be given in Standards VI. and VII.

Dirt dangers in the person, home, and community are selected for subject 2; cleanliness and comfort for subject 3; air, food, and water, subject 4; with hints on rest, work, and play. The series is concluded

by lessons on the care of the person, on the preservation of the health of the person and community. An outline scheme for teaching through the seven standards, and specimen-lessons are appended to this excellent paper.

Such experience as I have gathered *personally* leads me to emphasize in summary as follows:—

1. The vital need for close attention to the hygiene of school-rooms and life. I would ask, for instance, how any teaching in hygiene can appeal to the healthy instincts of childhood when they are allowed, or even authorised, to breathe a polluted school-atmosphere from day to day. Children are impressionable, and any such teaching becomes worse than useless, for it makes hygiene a sham and an object of ridicule when the laws they learn are daily broken. Ventilation is largely a matter of opening windows, and classes can often be given, in summer at any rate, in the open air. The herding together of many people, at work or at play even, in a foul atmosphere, together with inadequate nourishment, and finally the presence of infectious germs, are the potent causes of *tuberculosis*.

We may well note that school authorities in Paris recognise this in the fight against this human scourge, and send their children yearly into the country. At any rate the 11th Ward sends 3,000 children year by year, between the ages of ten and thirteen, for a three weeks' course of open air and good food yearly in a country-house in the Vosges Mountains in batches of 200.

Hygiene in the school-room and adequate nourishment is demanded, and might properly be supplemented by open-air classes, nature studies, and visits to the country.

2. The Ministry of Education, H. M. Inspectors, and Education Authorities should see that the elementary principles indicated previously are universally taught, and physical exercises carried out.

3. All hygienic arrangements should be supervised by medical officers with special knowledge and authority, so closely to my mind are the problems dependent on medicine.

4. Teachers should be required to show their knowledge and conviction of health-principles and the laws governing the spread of infective diseases before receiving their certificates.

5. The national conscience should be aroused to the need for safeguarding ourselves against disease by the formation of a Ministry of Public Health, and an organised health-service in all counties and districts.

OBITUARY.

Field-Marshal His Royal Highness George William Frederick Charles Duke of Cambridge, Earl of Tipperary, and Baron Culloden.

By SIR JOSEPH FAYRER, Bart., K.C.S.I., LL.D., M.D., F.R.S.
(Vice-President.)

THE announcement of the Duke of Cambridge's death on the 17th of March, 1904, was received with the greatest regret by the community generally, as well as by the public institutions over which he presided or with which he was connected, and which had benefited by his great experience and practical common sense, his cordial sympathy and his valuable co-operation. By none, probably, was the sad event more deplored than by The Sanitary Institute, of which, at the time of his death, His Royal Highness was the venerated and greatly respected President. It is in association with the affairs of this Institute that we now refer to the late lamented Royal Duke, the catholicity of whose sympathy with the Army of which for forty years he was the head (as well as with numerous charitable, beneficent, and other public bodies in which he took the greatest interest, and on whose behalf he exercised the influence of his generous, kindly, and philanthropic nature as well as that arising out of his exalted position) has been fully and gratefully acknowledged in the various obituary notices which have already appeared. It is, however, becoming that The Sanitary Institute, for which the Duke did so much, should place on record a separate notice of His Royal Highness's services on its behalf.

The Duke of Cambridge became a member of the Parkes Museum in July, 1883, when the Duke of Albany was President. On the incorporation of the Museum with The Sanitary Institute in 1888 he joined the amalgamated society, in 1895 was elected President, and from that time onwards his efforts had been strenuously devoted to its development. He was present at the Congress of The Sanitary Institute at Newcastle-on-Tyne in 1896, where he evinced the greatest interest in the proceedings, spoke at several of the meetings, and opened the Exhibition held in connection with the Congress. He presided at the twenty-first com-

memorative dinner of the Institute in July, 1897, which occurred during the busy period of the Jubilee celebrations, and on several occasions since then has taken the chair at the annual dinners.

Especially to be remembered, however, are the signal services that His Royal Highness rendered during the early history of the Institute. In 1885 the Museum was in serious difficulties for want of funds, and Sir Douglas Galton wrote a letter to the *Times* calling attention to its need of support. On seeing this letter the Duke of Cambridge wrote to Sir Douglas Galton, asking if he could help in any way to reinstate the Museum, and forthwith took an active part in furthering the success of a public meeting at the Mansion House, which he not only attended, but where he personally urged the importance of the undertaking, with the result of an accretion of funds which rescued the Museum and enabled it to be continued as the present successful and valuable public institution which is contributing to the sanitary welfare of the country.

The Sanitary Institute, whilst, like many other public institutions, deploring the loss of the Royal President, feels that its long period of active work in the past and its anticipation for the future has been materially influenced by the guidance and direction of the great man who, full of years (nearly eighty-five) and of honour, has passed away. The office vacated will not be an easy one to fill, but the memory of his predecessor's valuable work will be a stimulating incitement to the next incumbent to endeavour to follow in the footsteps of the great Prince, who made his exalted position ancillary to furthering the progress and welfare of an institution which, under his guidance, has become of great importance to the well-being of mankind.

The memory of the late Duke will long be preserved among scientific men, and his name will be associated with those of other great leaders in hygiene-work, which has resulted in the prolongation of life, the enhancement of the physical and, with it, the moral well-being of the human race. The Duke conferred great benefits on the nation, not only in his military capacity, but as a supporter of all those departments of science and art which contribute to human progress.

It was well said in Westminster Abbey by Canon Henson, "It is a great thing to say in summary of a career, lived throughout its whole course in the widest publicity and protracted to the extreme verge of human life, that it was the life of a typical Englishman, and as such commanded the affectionate respect of a nation which, beyond other nations, venerated sincerity, duty, and religion"; and by the leader in the *Times* of March 18th, "What public life will miss in him is the spectacle

of a bluff, loyal, hearty English gentleman, who carried a soldier's sense of duty into much more than his military occupations."

Such, indeed, was the character of the Royal Prince whose loss as its President The Sanitary Institute has to mourn, and whose memory will be cherished by the Institute in the growth and evolution of which he took so great a part.

SIR THOMAS SALT, BART.,

Vice-President.

By the death of Sir Thomas Salt, Bart., of Weeping Cross and Standon, in the County of Stafford, the Institute loses one of its most influential Vice-Presidents. Although in his 74th year, Sir Thomas continued up to the last to live a busy life, still taking an active part in the numerous philanthropic movements to which he has always devoted so much thought and energy, while at the same time he showed little inclination to sever his connection with the work of public authorities and commercial undertakings.

From Rugby Sir Thomas entered Balliol College, Oxford, taking his B.A. degree in 1853, with first class honours in Law and History, and his M.A. in 1856. On leaving the University he entered the banking house of Messrs. Stevenson, Salt, and Webb, of which his father, Mr. Thomas Salt, was the head, and which was subsequently amalgamated with Lloyd's Bank. In 1859 he was returned to Parliament as a moderate conservative by the electors of Stafford. On the dissolution of Parliament in 1865 Mr. Salt did not seek re-election, as the business of the banking house, owing to the death of one of the partners, required more close attention from him than was consistent with his idea of his duty as a representative of Stafford. Three years afterwards, the then members for Stafford having been unseated on petition, Mr. Salt was again returned to Parliament, but in the contested election of 1880 he was not elected, two liberals being returned for the Borough. The following year, however, one of the sitting members died and Mr. Salt was successful in the Parliamentary contest which followed and again represented Stafford in Parliament, this time as the only representative, the Borough, by the Redistribution of Seats Act, having lost one of its representatives. In the 1885 election Mr. Salt was defeated by the liberal candidate, but one year afterwards, in the election following the introduction of the Home Rule Bill, he was again returned to Parliament. Failing health prevented him from contesting the seat in 1892 and a liberal candidate was returned,

while in 1895, when Mr. Salt again contested the seat, his opponent managed to secure re-election by the narrow majority of 12 votes.

Sir Thomas, as a politician, was not a bigot, nor did he court sensation or popularity. That his value was appreciated in the House of Commons, however, is evident from the important offices which from time to time were entrusted to him. From 1875 to 1880 he acted as Parliamentary Secretary of the Local Government Board, and during the latter part of that period was also a Church Estates Commissioner. He was an Honorary Commissioner in Lunacy from 1882 to 1886, and Chairman of the Lunacy Commission from 1886 to 1892. He had been a Public Works Loan Commissioner since 1875, and an Ecclesiastical Commissioner since 1880. Sir Thomas was also an active worker on Parliamentary Committees, and it is interesting to note that he was Chairman of the Police and Sanitary Bills Committee when the London Public Health Act was passed. It is an open secret that Lord Iddesleigh thought so highly of Sir Thomas's abilities that he spoke of him as a suitable man for the post of Financial Secretary to the Treasury, or even as possible Chancellor. The somewhat fickle affections of the Stafford electors, however, broke that uninterrupted career in the House of Commons which, as a rule, is necessary for promotion to the higher posts of office. The baronetcy conferred upon him on his retirement from parliamentary work was no doubt intended as a recognition of his valued services during a long parliamentary career.

Notwithstanding Sir Thomas's busy life in Parliament and in connection with the large business undertakings in which he was prominently engaged, he was ever ready to take an active part in any movement having for its object the welfare and happiness of the people. In the public life of the County of Stafford he also took an active and leading part, and it can well be understood, considering his large and varied experience, that his valuable services were universally appreciated. For many years he was a Justice of the Peace and a Deputy-lieutenant for the County. He was a member of the County Council at the time of his death, having been elected among the first batch of aldermen in 1899; he devoted much time to the work of that body and served on the General Purposes, Education, Finance, and Sanitary Committees. The successful working of the County Council as a business body and a public health authority, and the entire absence of politics or personalities at its meetings, were contributed to, in no small measure, by the wise support given by Sir Thomas to the initial policy of his life-long and intimate friend Lord Harrowby, the late distinguished Chairman of the Council.

Sir Thomas was a staunch though liberal-minded churchman, and among his numerous other engagements he gave much time to diocesan work. He was a member of the Diocesan Conference, and was one of those elected by the lay members of the Conference as members of the Provincial House of Laymen. He was a diocesan trustee, an assessor appointed by the Court of Quarter Sessions under the Clergy Discipline Act, a joint treasurer of the Lichfield Diocesan Society for Promoting Church Extension, a trustee of the charity for the relief of widows and orphans of poor clergymen, and a member of the Lichfield branch of the Queen Victoria Clergy Fund.

Sir Thomas was a Trustee of The Sanitary Institute from 1879 to 1888; he was elected a Member in 1878 and later in the same year a Fellow, and in 1897 he accepted office of Vice-President.

Sir Thomas was not a man who lightly undertook responsibilities, but, having undertaken them, he spared neither time nor trouble in doing his best for the cause whatever it might be. That this was so is all the more remarkable considering the great business responsibilities which devolved upon him as Chairman of Lloyd's Bank up to within a few years of his death, and Chairman of the North Staffordshire Railway Company.

Sir Thomas leaves a widow, four sons, and two daughters, and is succeeded in the title by Major Thomas Anderdon Salt of the 11th Hussars, who is a Justice of the Peace for the County of Stafford.

G. R.

SIR HENRY THOMPSON, BART., M.B., F.R.C.S.,
VICE-PRESIDENT.

Sir Henry Thompson, surgeon, novelist, art critic, collector, and littérateur, after an active and useful life of over fourscore years, has passed away, and The Sanitary Institute mourns yet another gifted vice-president.

A man who would have been successful in any walk of life, of large views, and of unusual intellectual capacity, he was driven by his versatile nature to take part in a variety of movements, amongst them being hygienic advancement.

It was owing to his zealous encouragement and initiative that the Cremation Society was founded. In fact, his chief reputation as a hygienist is based upon his ceaseless advocacy of the safe sanitary method of burning the dead; he lived long enough to see his efforts crowned with a considerable amount of success, to see year after year additional crematoria constructed, and an ever-growing number of persons directing in their wills that their remains should be reduced to ashes.

Sir Henry Thompson has again and again pointed out that a whole

army of persons, some 50,000 strong, are buried annually on valueless, misleading, or imperfect certificates, and insisted on a reform of the whole method of registration of the cause of death.

Since accuracy alone makes the mortality statistics valuable, and the science of hygiene in great part rests upon such statistics, his contributions to current literature on this subject received the support of all engaged in public health work, and it is to be regretted that as yet no steps have been taken to carry out his views.

Although of late years Sir Henry has not been able to take an active part in the meetings and discussions of the Institute, he has ever been in sympathy with its aims and objects and willing to render assistance.

Sir Henry Thompson has been a Vice-President since 1890.

The Institute participates with a very large circle of personal friends in regret at his loss. A. W. B.

SIR EDWARD H. SIEVEKING, M.D.EDIN., F.R.C.P., LL.D.

Physician Extraordinary to H.M. The King.

Sir Edward Sieveking came of a Westphalian family long settled in Hamburg. Business brought his father to London in 1809, and the son was born in St. Helen's Place in 1816. He was educated partly in Germany, partly in England, and finally in Edinburgh, where he graduated M.D. in 1841. He began practice in Hamburg in 1842, took a leading part in founding a children's hospital there, and wrote a work on ventilation. He commenced practice in London in 1846, and contributed many reviews of foreign science and literature to medical periodicals. In 1855 he became Editor of the *British and Foreign Medico-Chirurgical Review*, a post which he retained for five years. In 1851 he was appointed Assistant Physician to the then newly established St. Mary's Hospital, with which he remained connected to the day of his death, becoming Physician in 1866, and finally, on his retirement in 1888, Consulting Physician. He was appointed Physician to the Prince of Wales's household in 1863, was afterwards Physician in Ordinary to Queen Victoria, and on the accession of King Edward VII. was nominated Physician Extraordinary. He was Croonian Lecturer at the Royal College of Physicians in 1866, Harveian Orator in 1877, and for a time held the office of Vice-President of the College. He was a voluminous writer, chiefly on pathology and diseases of the nervous system, but always displayed great interest in hygiene. He knew and admired Dr. Edmund Parkes, and at the meeting on July 18th, 1876, at which it was resolved to found a museum of hygiene as a permanent memorial to Parkes'

memory, Sieveking was entrusted with the duty of moving one of the resolutions. He was a Member of the Council of the Parkes Museum until its amalgamation with The Sanitary Institute, and gave his services to the Institute in a like capacity for a short period. He took a great interest in the movement for the improvement of sick nursing, in the work of the Red Cross Society and the St. John's Ambulance Association, and assisted Mr. Propert to found Epsom Medical College. Sir Edward Sieveking was a man of great industry, independence, and force of character, who led a very full and useful life, during which he conferred many benefits on the country of his adoption. D. W.

HENRY SAXON SNELL, F.R.I.B.A.,

FELLOW AND MEMBER OF COUNCIL.

Mr. H. Saxon Snell, whose death occurred on January 10th, in his 73rd year, was one of the earliest members of The Sanitary Institute, and came on to the Council in 1879. He was for many years a member of the Board of Examiners, one of the Judges of the Exhibition, and an active member of other standing committees.

His principal professional work was in connection with Poor Law and municipal buildings, and the workhouses, infirmaries, and dispensaries designed and erected by him make a long list of well-known buildings.

Hospitals, also, he was much interested in, and the Royal Victoria Hospital at Montreal, the Forres Hospital, N.B., the Hospital for the Sick Poor in Rackham Street, and the Victoria Hospital for Children are among those designed by him. At the Congress of The Sanitary Institute in Leicester in 1885, he read a paper on "Circular Hospital Wards," and it is not too much to say that his exposure therein of the fallacies of the system did much to stay its adoption in this and possibly in other countries. In conjunction with the late Dr. Mouatt he published "Hospital Construction and Management," a work in which he described in comparative form all the best types of hospitals in this and other countries.

In connection with this work he visited a number of the hospitals on the Continent in company with Dr. Mouatt and Mr. P. Gordon Smith (late architect to the Local Government Board); he also visited several in America. He continued his interest in the subject to the very last, and only the week before his death he was discussing a scheme for utilizing the public parks as sites for hospitals.

His principal work in hospital design is a building not much known over here, the Royal Victoria Hospital, Montreal, erected in 1889, which is in many respects in advance of anything done in this country before or since.

For the past twenty-five years he took a very keen interest in the subject of ventilation, and as far back as 1882 published the result of a number of experiments made personally to test the accuracy of registering anemometers. Later on, when living at Hampstead, he erected in his stables a gas-engine and other plant for the purpose of continuing these experiments.

He was fond of mathematics, although probably he studied them rather as a means to an end (and that end mental clearness) than as an amusement. His papers show that he studied the integral calculus long after he was in practice, at a time when most men are content to limit their studies to the school of experience. Many of the members of The Sanitary Institute know that he was interested in improvement of all kinds of sanitary apparatus, and with the object of furthering this branch of sanitary work he has bequeathed to the Institute a sum of £750, to be applied as to Fifty Pounds thereof, and as to the income of the remaining £700 every third year afterwards for a Scholarship or Prize, to be called the "Henry Saxon Snell Scholarship or Prize" to encourage improvements in the construction or adaptation of Sanitary Appliances.

On account of failing health Mr. Snell had for several years been unable to take an active part in the Institute, but his genial personality will be long remembered by his colleagues on the Council and in the Institute.

T. W. C.

DECISIONS OF COUNCIL ON RESOLUTIONS PASSED AT MEETINGS OF THE INSTITUTE.

Recommendation made at the Sessional Meeting in London on December 9th.—

"That this Meeting is of opinion that the Flooding of London Basements with sewage is a grave menace to public health and regrets that this menace has been allowed to continue for so many years, and requests the Council of the Institute to urge the London County Council to proceed with all possible expedition to the completion of the necessary works upon the main sewers and relieve London from its present insanitary state."

The Council resolved that in view of the grave danger arising from the Flooding of London Basements, the Institute desire to urge on the London County Council the desirability of expediting in every way the works undertaken for removing the evil.

NOTES ON LEGISLATION AND LAW CASES.

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For full text of these see Law Reports, which can be referred to in the Library of the Institute.

WATERWORKS.—*Land compulsorily taken—Compensation—Special adaptability.*

Where land is compulsorily taken for the purpose of making a reservoir, the fact that the land has peculiar natural advantages for supplying a district or area, apart from any value created or enhanced by the scheme or Act for appropriating the water to a particular local authority, may be taken into consideration in the assessment of compensation; and it is not necessary that it should be proved that the land could be similarly used by other specified local authorities.

Judgment of Wright J. (1903) 1 K. B. 574, affirmed.

In re Gough and Aspatria, Silloth and District Joint Water Board, C. A. (1903) 417.

LODGING-HOUSE.—*Lime-washing—Validity of By-law—Public Health (London) Act, 1891 (54 & 55 Vict. c. 76), s. 94, sub-s. 1 (d), (e).*

In two metropolitan boroughs a by-law with respect to houses let in lodgings was made by the Council of the borough under s. 94 of the Public Health (London) Act, 1891, requiring the landlord of a lodging-house (the definition of which included any house occupied by the members of more than one family) to cause every part of the premises to be cleansed, and the ceilings and interior walls to be lime-washed, in the first week of April in every year. In one case "landlord" was defined as the person who received the rack-rent of the premises; and in the other case the definition included the person who received the profits arising from the letting of the house as a lodging-house:—

Held, that having regard to the wide definition of lodging-house and landlord the by-law was, in both cases, unreasonable and bad, because it contained no provision that a landlord, before becoming liable to a penalty for a breach of the by-law, should receive notice that the requirements of the by-law had not been complied with:

Held, also, by Lord Alverstone C. J., and Kennedy J., Willis J. dissenting, that so far as the by-law required the work to be done in the first week of April, the by-law was not unreasonable.

Stiles *v.* Galinski. Nokes *v.* Islington Corporation (No. 2). Div. Ct. (1903) 615.

SANITARY INSPECTION OF SCHOOLS.

Dr. Butler-Hogan, the Medical Officer of Health for Tottenham, applied on January 28th for a justice's order to inspect the Drapers' Schools in his district, to which the sanitary officials had been refused admission, in the first place by Miss Beggs, the head mistress, and afterwards by Mr. Riley, the surveyor to the Company. The medical officer explained that the application was made under Sec. 102 of the Public Health Act, 1875, the wording of which was, in his opinion, absolutely clear upon this point, the words being: "The local authority

or any of their officers shall be admitted into any premises for the purpose of examining as to the existence of any nuisance thereon." It was most important that there should be the same right of entry and inspection with regard to the most lordly premises as there was to the poorest hovel in the district: this was even of still greater importance when the premises were schools. One sixth of the population of Tottenham, and probably the most important sixth, consisted of school children. He had offered to have the inspection made during the Christmas holidays, so as not to interfere in the slightest with the work of the school, but the officials of the company had perhaps calculated that he might be too lazy or too cowardly to carry this matter through the Law Courts.

In no other school in the district had there been the slightest opposition to the sanitary officials in the discharge of their duties.

Mr. Nairne, on behalf of the Company, opposed the application on the grounds that the medical officer of health had arbitrarily refused to specify any particular grounds of complaint, and had claimed a general right of inspection at any time. He deprecated the medical officer's remark regarding the Company, who were quite satisfied that their surveyor (Mr. Riley) took every possible care of the sanitary condition of the schools. The drainage had been seen to some five months ago, and he believed it was right now. He thought the medical officer should be called upon to particularise any complaint he had received, and submitted that unless this were done the justices were not entitled to grant an order, and he quoted the case of Vyne, under the Public Health (London) Amendment Act, as being on a similar footing.

Dr Butler-Hogan, in reply, said that he did not wish now to discuss any Act which did not apply to his own district, and that under no circumstances would he disclose information received in confidence by him; the words of the Section were, he again reminded the Bench, "for the purpose of examining as to the existence of any nuisance," not for the purpose of verifying or corroborating the existence of such.

In the result the Bench granted the medical officer the order applied for.

GENERAL NOTES.

SEWAGE DISPOSAL BY THE PAIL SYSTEM IN KING WILLIAM'S TOWN, CAPE COLONY, S.A.

By C. Anthony.

It has occurred to the writer that a brief note on the excellently organized system of sewage and refuse-disposal in force in the Town of King William's Town, Cape Colony, might be of interest to the Institute.

The Town, 1,300 feet above sea-level, has a population of about 7,000 Whites, and 3,000 Natives, or a total of 10,000 inhabitants.

The system of sewage-disposal is the pail, which, under the intelligent direction which prevails, has proved itself well able to cope with the removal of the waste-products of a town of this size, even under the trying climatic conditions which prevail, King William's Town being one of the hottest spots in the Colony.

In accordance with By-laws promulgated in March of 1898, the citizens are obliged to build privies to the satisfaction of the Borough Council, and to provide for each a couple of galvanized iron pails having closely fitting covers and detachable handles. These are supplied of a standard pattern by the Council at a charge of 8s. each.

These pails are removed as often as may be required, but never less than once a week, the Sanitary Inspector being made the sole judge of the number of weekly removals necessary, and a proportionate charge is made of 9s. per quarter for one removal, 15s. for two removals, 21s. for three removals, and 42s. for six removals weekly.

The removal is effected by a properly organized night-service of closed vans, provided with racks to carry pails to the number of sixty per van. These visit certain districts in rotation carrying empty pails, which are substituted for the full ones removed.

For the disposal of the night-soil thus collected, a plot of ground some thirty acres in extent has been set apart a mile east of the Town. Trenches some 2 ft. 3 in. wide and 1 ft. 6 in. deep are cut in parallel lines at a distance of about 6 ft. from centre to centre, the amount of trench cut and filled each day averaging about twenty lineal yards. Into one of these the night-soil is thrown, being immediately covered with kitchen-refuse brought by a separate system of ordinary ash-carts. The trench is about half filled in this manner, the filling being completed from excavation of a continuous trench.

After several rows of trenches have thus been filled, trees are planted not in the trenches themselves, but in the ground between them. The class of trees found most appropriate are the Eucalyptus rostrata and tereticornis, the Pinus halepensis and the Black Wattle. These are first grown, for from six to nine months to a height of at least one foot, in ordinary soil, before being transplanted to the depositing grounds.

The pails emptied of their contents are taken to an open galvanized iron shed, where they are thoroughly washed in running water three times, and scrubbed with stiff bristle-brushes. They are then dipped in a disinfecting solution consisting of one gallon of Jeyes' fluid to fifty gallons of water, and are stacked to dry, ready for use the next day. Special pails of a distinctive pattern, easily distinguished from those in ordinary use, are issued on the notification of the existence of infectious disease by the medical officer, and these are removed in a special van and are cleaned and disinfected in a separate shed.

In the case of domestic houses the urine is of course removed in the pails together with the night-soil, but when large establishments are in question, such as schools, hotels, manufactories, and public buildings, urinals are fitted draining into pails containing sawdust. These are emptied into a urine-tank-cart, and are dealt with in the same manner, and at the same charge per removal, as the night-soil pails.

The kitchen- and bath-water, slops, &c., are allowed to flow by the surface-concrete or stone-curb-gutter of the streets to the River Buffalo. The gutters are regularly swept by employees of the Council, and the throwing of any injurious matter into them is a punishable offence.

The population served may be taken as 7,000, and the staff employed consists of three men with each of the six collecting vans in constant use, two men with each of the two urine-tank-carts, and a foreman in charge of the depositing ground, with four men trenching and three washing; or a total of thirty men in addition to the Inspector and clerical staff.

FIRST INTERNATIONAL CONGRESS OF SCHOOL HYGIENE, NUREMBERG, APRIL, 1904.

By F. E. Batten, M.A., M.D., F.R.C.P.

This Congress was held at Nuremberg in April, 1904. The English interests at the Congress were represented by a special committee formed by members of various organisations interested in education and school hygiene. The formation of this committee was due to the energy of the medical officer to the London School Board, Dr. James Kerr. The English committee includes representatives of the following bodies: the Royal College of Physicians of London, the Royal College of Surgeons of England, the London School Board, the Medical Officers of Schools Association, the Incorporate Society of Medical Officers of Health, the London School of Medicine for Women, the Childhood Society, the Child-Study Association, the National Union of Teachers, and The Sanitary Institute, and was under the presidency of Sir Lauder Brunton.

The number of members of the Congress amounted to 1,700, and included not only medical men and schoolmasters, but a large number of persons interested in education and hygiene, but only about 900 members were present at the Congress. The general meetings of the Congress were held in the Apollo Theatre, and were largely attended.

The opening of the Congress was performed by His Royal Highness Prince Ludwig Ferdinand of Bavaria, and it was obligatory on the delegates to appear in evening dress.

Professor Griesbach, the President of the Allgemeinen Deutschen Verein für Schulgesundheitspflege, to whom all credit is due for the inauguration and success of the Congress, said that no less than twenty European and extra-European States (United States and Japan) were represented at the Congress, and that Turkey and Italy alone were unrepresented. The delegates from the various countries then spoke, and Dr. A. Eichholz, His Majesty's Inspector of Schools for the Blind, Deaf, and Defective, replied on behalf of Great Britain.

The Exhibition and Sectional Meetings of the Congress were held in one of the school buildings, of which there are several in the town. The building was most excellently adapted for the purposes of the Congress. On the ground floor was an office and central bureau, where all information with regard to the meeting could be obtained, and where the daily journal was issued. There was no difficulty in obtaining the necessary cards and information with regard to the Congress, and the general management of the business was excellent.

In the basement of the building was held the exhibition of apparatus, books, games, educational diagrams, plans of ventilation, and architectural drawings of school buildings.

On the upper floor rooms were provided as reading room, offices, and for the work of the various sections. These were well arranged, and there was no difficulty in finding any section required.

The sections were well attended and the discussion well maintained.

The work of the Congress consisted of general meeting and sectional meetings: the first were practically addresses, while the second were papers on which discussion took place.

At the general meeting the following papers were read:—

(1) What have ophthalmic surgeons done for school hygiene, and what has yet to be done?

(2) The position of school hygiene in Norway.

(3) The hygiene and personal health of the master in relation to his pupils.

(4) The arrangement of elementary schools according to the mental capacity of the children.

(5) The duties and education of the school doctor.

(6) The prevention of infectious diseases in schools.

(7) What is most required in school ventilation?

At the close of the formal business of the first general meeting of the Congress Professor Cohn (Breslau) read a paper entitled "What has the Ophthalmic Surgeon done for School Hygiene and what remains to be done?" He stated that Myopia might be regarded as a widespread disease produced by school life. Further experience in the last ten years had shown that the acuity of vision in young children examined in the country was twice or three times as great as that of a child examined in the school room—similar to the great acuity of vision which was present in the Bedouin Arab. Unfortunately, the acuity of vision very rapidly diminished during the years of school life. The true cause of short sight was not even yet fully known, although there were various hypotheses. One thing was certain—that much close work, especially in association with hereditary disposition and bad lighting, produced myopia. With regard to the result attained by attention to the ocular condition of the children, it is interesting to note that in spite of all that has been done the percentage of children with short sight has not decreased.

Dr. Benda (Berlin) spoke on the subject of over-pressure in the more advanced classes. He recommended the abolition of the so-called Abiturienten-Examen (the final examination which entitles young men to matriculate as students at the universities). No lessons should be given in the afternoons, so that the children might have ample opportunity for bodily exercises and games. Home lessons ought to be limited as much as possible. Special classes for defective or backward children ought to be arranged in the gymnasia, as was already the case in the municipal schools. The more advanced pupils ought to be at liberty to select the classes they wished to attend with a view to their future occupation or position in life. In this way the change from the restraints of school training to the wider circle of university studies would become less abrupt than under the present system.

At the last general meeting of the Congress Dr. James Kerr read a paper entitled "What is Most Required in School Ventilation." He said there was required for all schools some efficient method of ventilation. In small rooms this might be a modified natural system, by fires or ventilating stoves. Other systems depending on roof ventilators and climatic conditions were fallacious and whilst acting during some seasons of the year, failed in summer, and caused draughts in winter. Open windows, doors, and fireplaces, or extraction chimneys, could, by a rigorous system of window drills and the constant supervision of a skilled teacher, be utilized for most of the school year to maintain a comparatively pure air, but even these methods would fail when most wanted, as in summer. For large schools direct mechanical movement of the air was best by large fans running at low speeds. In order to avoid "short-circuiting" by opening of doors, all ducts should be as large as could be afforded and the outlets of low resistance; inlets to rooms should be high on the walls, outlets low; 2,000 cubic feet per head per hour, should be supplied. Accessory heating preferably by low pressure steam or water was advisable. The air should be well moistened.

Cloakrooms and stairways must also be ventilated. At present the chief objection to the mechanical ventilation was the sense of loss of tone from want of sufficient skin stimulation by the smoothly flowing warmed air. Probably the system of the future would be one of large supplies of very moderately heated air moved by combined propulsion and extraction by fans, with accessory heating of rooms and free permission to open doors and windows.

An interesting paper was read dealing with the arrangements of the primary Schools. Children in Germany attend school from the age of six to fourteen, and there are eight classes. Besides these ordinary classes there are so-called repetition classes for backward children; then again other classes for mentally defective children; other classes for morally defective children. Besides these there are classes for secondary education. The complication of such a scheme seems to be very great, but according to the speakers the arrangement had worked well in the town in which it was instituted.

The sectional work of the Congress was divided into seven sections:

(1) Dealt with School Buildings and Furnishing of the Schoolroom.
(2) The Hygiene of Residential Schools, the Methods of Hygienic Investigation and Research in Schools, and the Physiology and Psychology of Educational Methods and Work.
(3) Instruction in Hygiene for Teachers and Scholars.
(4) Physical Education and Training in Personal Hygiene.
(5) Contagious Diseases, Ill-health, and Conditions affecting Attendance at School.
(6) Special Schools, including Feeble-minded, Blind, Deaf, Dumb, Cripple, Invalid, and Exceptional Children.
(7) Out-of-School Hygiene, Holiday Camps, the Relation of the Home and School and the Hygiene of the Teaching Profession.

Without going into details it may be said that some of the most interesting papers were read in the sixth section. A paper by Dr. Gutzmann on Stammering and Stuttering provoked a considerable amount of discussion, and another by Dr. Wanner on the Testing of Hearing in School Children was also the subject of considerable criticism.

Dr. Clement Dukes (Rugby) read a paper on the Organisation of Physical Education. He said that the physical development of the body was of importance for the mental development, and that an energetic manhood could only be obtained by a healthy boyhood. He was of opinion that school games were important for the education of the boy, that such games should be made compulsory on all boys, and just as times were arranged for work in school, so there should be a definite arrangement of play. A boy who did not play became dull and apathetic, and became unfitted for the struggle of life. He was not in favour of Swedish exercises except in certain instances. Excessive exercise was as bad as deficient exercise and tended to stunt the body. He pointed out how necessary it was for a boy to train for his games, and he stated that most accidents during play happened at the beginning of a season, when a boy returned from holidays and in an untrained condition took up some violent form of exercise. The boy was an active animal, and it was important to give him active employment, or he would almost certainly find some occupation which might not only be useless but even dangerous. For young children he considered carefully arranged physical exercises most important, but it was to be remembered that the staying power of the young child was very limited.

The tendency of the Congress was to advocate increased specialism, not only in educational work but also with regard to medical supervision. With regard to the educational work, separate schools should be provided for the blind, deaf, defective, epileptic, and moral pervert. With regard to the medical supervision, it was suggested that besides a medical officer to each school it was necessary to have an ophthalmic surgeon, an aurist, and a dental surgeon.

A large portion of the exhibition was occupied by school desks in various forms; the general arrangements seemed to be to make the desk and seat to accommodate two children and various devices had been adopted to allow the children to stand up in their places and yet to bring the desk sufficiently near them to prevent them stooping over their work. This arrangement differs from that adopted in the English schools in that the desk is made continuous while the seats are separated for each child. Such an arrangement allows the teacher to pass behind the children and to give to each child room to stand up at the side of his place, whereas in the arrangement shown in the exhibition the teacher is at the side of the scholar and cannot pass behind him. Various mechanical arrangements were shown for adjusting the desk and seats to the varying size of the children, but all more or less complicated. One form of drawing stool may be especially mentioned as it is both ingenious in design and most comfortable to work at. It is shaped as a somewhat flattened horseshoe on four legs. At one end a pillar is fixed which carries a drawing board which can be adjusted at any angle and at any height. From the same pillar an arm projects which carries a stand on which the object to be drawn is placed. The student, male or female, sits on the other end of the horseshoe with the legs in the concavity, or if the student be a male he can sit on the stool in a straddle manner. The only objection that can be raised to such a stool is the fact that it occupies a considerable amount of floor space as compared with a chair, but in comparison to an easel it occupies but a small space.

Mention may be made of a simple form of hygrometer for school use. The advantage of knowing the amount of moisture in the atmosphere of the school-room is obvious, and means can be taken to correct the defect. Some of the diagrams for instruction appear to be worthy of note, and one showing the joints cut from the bullock would seem to be of considerable use in the education of girls in housekeeping.

Some of the models illustrating the anatomy of the human frame would appear unnecessarily complicated for such simple facts as are required in the education of children.

The type-writing machine, as used by the blind, is of interest. It in some way resembles the "Brail system," out of the various combinations of six keys any letter can be made and can be read either by the blind person or by sight. The disadvantage of the process is its extreme slowness, for the formation of nearly every letter requires the keys to be depressed three times.

The next meeting of the Congress will be held in London in 1907, and The Sanitary Institute sent a proposal to the meeting at Nuremberg offering to co-operate with the English Committee in the organisation of the meeting, and to conduct the Exhibition.

The Institute has also arranged for a short Conference and Exhibition relating to the subject to be held in January, 1905.

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DISCUSSION ON

SCHOOL HYGIENE IN ITS RELATION TO EDUCATION AUTHORITIES.

Opened by E. WALFORD, M.D., D.P.H.,
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(FELLOW).

At Provincial Sessional Meeting at Cardiff, April 23rd, 1904.

WHEN the Council of The Sanitary Institute was good enough to invite me to open a discussion at this Sessional Meeting in Cardiff, I experienced some difficulty in the choice of a subject likely to prove generally acceptable. Ultimately it seemed to me that we might perhaps usefully devote the short time at our disposal this morning to the consideration of one aspect of the education question which has not yet attracted the public attention to the same extent as other more exciting and controversial points. If we can for a moment divert the attention of those interested in educational matters from these to other, but not less useful, points connected with the health and physical welfare of the scholars, we shall, perhaps, have effected some little good. In choosing the subject of School Hygiene, I was influenced by what I hope will prove to be a well founded belief, that we should on this occasion have the advantage of the presence of some educational experts and others who have made this subject a special study, and who would be able to deal with many technical and special details with more skill and knowledge than I could hope to do. With this in view I shall only attempt a brief general survey of the question.

The present moment seems to be a suitable one for directing special attention to the subject of School Hygiene. Recent legislation has, as you are aware, transferred the management of our Public Elementary

Schools to the local authorities which are already in existence and which are intrusted with other powers and duties, especially those concerned with the public health. Practically, therefore, the educational authority and the sanitary authority are one and the same body. A fitting opportunity thus presents itself for organising a systematic and effective method of supervising the sanitation of schools and of promoting the health of the scholars on a more scientific basis than has hitherto obtained. Parliament seems to be more and more inclined in the direction of Decentralization in every Government Department and the Education Department forms no exception to this rule.

A wide discretionary power will therefore devolve upon the local educational authorities in the administration of many important matters and details connected with the working of the schools under their control. Fortunately, we have every reason to anticipate that they will exercise their powerful influence in the right direction. We must recognise, nevertheless, that School Hygiene is a department of public health of comparatively recent growth, and that it is yet in this country in an early stage of development.

The comparative neglect of hygiene in connection with school-life in time past was probably due to erroneous ideas upon the subject of education. The development of the mind and of the intellectual faculties was regarded altogether apart from the physical development of the body, regardless of the fact that the organ of mind, the brain, is an essential part of the body, and that nature has allied all the wonderful mental functions, upon which we pride ourselves, with a bodily organisation, and that the slightest damage to this organisation reacts upon those important functions. An original or acquired defect in the structure of the brain may render futile all the best efforts of the most accomplished teacher. Injurious impurities contained in the air taken into the lungs may enter the general blood circulation and seriously derange the mental faculties of the most intelligent pupil; a continuation of this process, constantly perverting the bodily and mental functions, may lead to permanent organic changes and disease. It is, therefore, a matter of grave national concern that teachers and pupils should carry on their educational work under the conditions most favourable to health. The problem for solution is, therefore, how can such conditions best be attained? It goes without saying that it is the duty of the Education authorities to provide the best attainable conditions, so as to promote the mental and physical welfare of the pupils under their care. Education authorities, whether central in London or local bodies, are largely influ-

enced in their methods by public opinion. It is the public generally, therefore, who must in the first instance be interested and convinced.

In the matter of school-hygiene some other countries are at the present time in advance of ourselves. The schools in America, Germany, and Switzerland compare favourably with anything that we have in this country. Mr. A. G. Legard, H.M. Inspector of Schools for this district, in a most interesting and instructive address to the Cardiff Architects' Society in 1902, remarked, that "In England popular opinion has not yet pronounced in favour of the people's schools being of the very best type, and till that takes place we shall have lessons to learn in school architecture, not merely from our rich kinsmen across the Atlantic, but from the inhabitants of a poor country like Switzerland." In some of the Swiss cities, he says, the primary schools rank among the finest buildings, and are sources of honest pride to the inhabitants.

The Sanitary Institute, always well to the front in the promotion of hygienic knowledge, has recently and most opportunely interested itself in the theoretical and practical instruction of those who have embraced the profession of teaching. A glance at the admirable and comprehensive syllabus issued for the guidance of students preparing for the special examination in hygiene for school teachers, which has been established by the Institute, will suggest the enormous advantage, to school children, of being under the control of teachers possessing, even in an elementary degree, a knowledge of the subjects there set out in detail, and who are able and willing to put that knowledge into actual practice. It is not of course to be expected that all teachers in our public elementary schools should be experts in sanitation, but at the same time it is perfectly obvious that there can be no real advance or improvement in our methods of school sanitation until the responsible teachers possess a fair knowledge of the principles upon which these methods should be based. The most clever and learned teacher will be a failure, from an educational point of view, unless he or she recognises that the health of the scholar is as important as its mental growth and intellectual development, and that unless the environments of the child are such as to secure the former, satisfactory results with respect to the latter can hardly be expected. It must in all fairness be acknowledged that many of the teachers in our public elementary schools are alive to the importance of maintaining in the schools under their control a proper standard of sanitation.

They possess, moreover, in many cases, a sound theoretical knowledge and practical acquaintance with the general laws of health, and the positions they hold and the profession to which they belong would

naturally imply the possession of a highly trained intellect and cultured mind. The active and intelligent co-operation of teachers is therefore essential to the success of any organised scheme of school hygiene.

In this matter the responsibilities are divided between (1) the Central Authority or the Board of Education, (2) the Local Education Authority, and (3) the officials or teachers having immediate control of the schools. With the Board of Education we are not so much concerned to-day; as an organisation for propounding excellent principles it would appear to be everything that could be desired. It is the Local Authority, the school managers and the teachers with whom we have to deal, who are intrusted with the duty of carrying into effect the principles admirably laid down in the various codes, regulations and memoranda of the Board, and who are therefore immediately responsible for maintaining an effective supervision over their schools. The Central Board has doubtless at its disposal the best expert advice in the country, and a staff of highly qualified and efficient inspectors, but it has apparently no very effective machinery for enforcing the recommendations which it makes: much, therefore, is left to the discretion of the local bodies. It is hardly necessary before an audience of this kind to dilate in detail upon the evils likely to arise from a policy of neglect and indifference on the part of those responsible, but there are certain points which I think that we cannot too frequently emphasise: points which are constantly brought to the cognizance of medical officers of health, and of those who are in the habit of visiting schools officially and unofficially, which indicate the necessity of some better method of exercising sanitary supervision over these places. I will mention one or two simple examples in this connection, not however with the view of selecting any particular schools for adverse criticism, as I believe similar conditions could be found elsewhere. One day on visiting a class-room in the infant department of one of our public Elementary Schools I noticed that the air was unusually stuffy, and that most of the windows were shut. On making inquiry I was told the reason: One of the assistant teachers was suffering from toothache and was afraid of a draught. This was one of the class-rooms, of which there are many, which from inadequate arrangements and appliances could not be ventilated without creating a draught.

On another occasion I found in a large class-room of one of the elementary schools all the windows firmly closed, the only opening to the fresh air being a small permanent ventilator in the roof, which probably would also have been closed but fortunately it was sufficiently inaccessible, and notwithstanding complaints of descending currents of cold air it had

remained open. I was accompanied by the chemist attached to our Public Health Laboratory, and we were about to take a sample of air for examination, but before we had time to look round, the head-master gave hurried instructions to a small boy to open the windows and the opportunity was lost. These are simple everyday examples of what is to be found in many school-rooms in which the heating and ventilating arrangements are so inadequate that it is impossible to open a window without creating an unpleasant draught of cold air, consequently they are kept closed. Examples of this kind are doubtless familiar to most of us, and further comment seems hardly necessary; but perhaps I may be permitted to give the results of some analyses of the air of school-rooms made for me by Mr. J. H. Sugden, in our laboratory. Taking the universally recognised standard of 4 parts per 10,000 as the amount of carbon dioxide present in fresh air, and 6 parts per 10,000 as the limit which should not be exceeded in an inhabited room, and assuming as is usually done that the quantity of CO_2 present is an approximately accurate index of harmful organic impurity in the air, it must be admitted that few of the rooms examined reached a high degree of excellence so far as the purity of the air they contained is concerned. The air of twenty-six class-rooms was examined and the amount of CO_2 found to be present ranged from 6·2 to 18·0 parts per 10,000. In three of the rooms the amounts ranged from 16·0 to 18·0. In twelve rooms between 9 and 14 parts, and the remainder between 6·2 and 9·0 parts per 10,000. The examinations were made between 2.30 and 4.30 p.m., in February and March. In sixteen of the rooms the temperature ranged from 54° to 59° F., in the others between 60° and 62° F.

These results are not of course brought forward as representing anything like a complete examination of the air of our schools, nor with the intention of suggesting that the ventilation of the rooms examined was in a worse condition than that of the generality of schools in this or any other district in the country, but rather with the object of indicating the necessity of a systematic and constant chemical and bacterial examination of the air of public schools, and of a more efficient control over the ventilating arrangements of these buildings.

In the report of the Departmental Committee on Factory Ventilation (1902), Dr. J. S. Haldane shows that the average proportion of CO_2 in a large number of workrooms amounted to 10·1 volumes per 10,000 in the daytime, and that this compared favourably with the average proportion found in the elementary schools of Dundee, which amounted to 18·6 volumes per 10,000 with natural ventilation and 12·3 volumes with

imperfect mechanical ventilation. To the impurities from respiration must be added those due to the combustion of coal gas when artificial illumination is necessary, a by no means infrequent occurrence in some schools. Fortunately however, as most school-rooms are fairly high and the products of combustion are lighter than air, the circulation of the vitiated air from gas jets is to a large extent above the breathing level. With a proper system of control over the sanitary arrangements of schools on the part of the Local Education Authorities, there would be, I presume, nothing to prevent the adoption of a standard limit of carbon dioxide. A notification sent by the responsible authority to the head-master or mistress whenever this limit was found to have been exceeded, would probably in most cases lead to more attention being given to the existing means of ventilation and warming. There can be no doubt that in many of the old schools and in some of the new the warming arrangements are very imperfect, and that this greatly adds to the difficulty of admitting a proper amount of fresh air. Notwithstanding the excellent rule of the Board of Education that an "iron stove, with a pipe through the wall or roof, can under no circumstances be allowed," many of these objectionable heating appliances are to be found, and it is to be feared that those responsible have taken literally the preamble to the rules which states that "they are intended to show school managers and their architects what the Board deem essential in the construction and design of school buildings, but in other respects they are not meant to restrict liberty of treatment." On a recent occasion my attention was drawn to a certain school in which it was alleged that in one of the girls' class-rooms many of the pupils were constantly attacked with illness. The symptoms, as described by the head-mistress, who was an intelligent observer, were headache, sickness, extreme drowsiness, passing in some cases into more or less complete coma or syncope with convulsive muscular movements. The history of the cases and the symptoms were extremely suggestive of poisoning with carbon monoxide gas. This gas, as is well known, is extremely dangerous when breathed into the lungs, combining with the hæmoglobin of the blood, and therefore interfering with its function as a carrier of oxygen, and producing asphyxiation. It is sometimes introduced into rooms in which cast-iron stoves are used with coke as fuel. Under these circumstances the products of combustion from the stove or flue gain access to the air through the heated iron, and the carbon monoxide is evolved. In this particular room there was one of these cast-iron stoves with a pipe through the wall, which the Board of Education states should not under any circumstances be allowed. This

arrangement infringed all the conditions under which only stoves are approved by the Board, *i.e.*, (1) It was not provided with a proper chimney (as in the case of open fires); (2) It was not of such a pattern that it could not become red-hot or contaminate the air; (3) and it was not supplied with fresh air direct from the outside by a flue of not less than 72 inches superficial. It is only right to say that a sample of the air was submitted in our laboratory to Vogel's spectroscopic test and that no indication of the presence of carbon monoxide was given. This single negative test was of course no indication that the gas was not present on other occasions.

The ventilation and warming of schools is undoubtedly a matter of some difficulty. It is obvious that we cannot depend upon open fireplaces for heating distant parts of large school-rooms or class-rooms, valuable as they are as aids to ventilation, therefore some form of hot water or steam heating is necessary, and this usually implies some method of artificial or mechanical ventilation, as no system of heating can be satisfactory which does not at the same time assist ventilation. There is, I think, a consensus of opinion that for large schools and class-rooms better results can be obtained by mechanical than by natural ventilation. For instance, we have the authority of Dr. Kerr that in the Bradford Elementary Schools the amount of CO_2 in the mechanically ventilated rooms was never found to be above 8·5 vols. per 10,000, whilst in the so-called naturally-ventilated schools it was never below 9 vols., and reached as high a figure as 31 vols. of CO_2 per 10,000. In well-ventilated schools it should be possible to supply from 1,700 to 2,000 cubic feet of air per child per hour, entering the room at an average velocity not exceeding five feet per second. This is quite impossible without mechanical ventilation. It may be said also that the lighting of schools is connected with ventilation. It is to be feared that in some rooms the assistance of the gas jet is invoked as an aid to the imperfect heating arrangements regardless of the increased contamination of the air. Hence the value of the electric light, the most sanitary of all artificial means of lighting. Probably the most urgently needed reforms in most large school-rooms are improved methods of heating, combined with an artificial system of ventilation, such as the Plenum system, or the Plenum in conjunction with a properly arranged exhaust system, and the installation of the electric light. Any such improvements necessarily require for their complete efficiency a much larger amount of air space than is at present required by the Board Regulations for each unit of average attendance. In these matters school authorities should take the advice of independent scientific experts.

Amongst other important points connected with the structure of the school-room, or rather perhaps with the furniture of the room, which have as yet received far too little attention may be mentioned the form of desk and seat at which the pupil has to spend so much time. It is a wonderful and painful sight to behold a child on his or her return home for the holidays attempting to write a letter. From the remarkable muscular and facial contortions gone through, one can only wonder that spinal curvature, impaired vision, and St. Vitus dance are not of more frequent occurrence. Imperfect forms of desks and seats and improper modes of handwriting are largely responsible for those disorders when they occur amongst school children. Certainly improvements have taken place recently, but even now are to be found rows of desks and benches which perhaps might not be so unsuitable if children of the same age were always of the same size. I have never been able to see the advantage of paragraphs (*a*) and (*c*) in the new rules of the Board of Education issued 1902, which are as follows:—"No desks should be more than twelve feet long. In an ordinary class-room five rows of long desks or six rows of dual desks are best, but in a school-room, or a room providing for more than sixty children, there should not be more than four rows of long desks or five rows of dual desks . . . Single desks are not necessary in an ordinary public elementary school and cannot be approved." Perhaps there are some here who will be able to explain this emphatic disapproval of single desks. I am personally much inclined to think that there are great advantages in single and properly adjustable desks and seats, advantages to the physical state of the pupil and possibly educational advantages. In any case our American friends are strong advocates of single desks. Professor Shaw, of the New York University, states that "every school ought to be furnished with single desks and seats. No double desks, or desks at which four pupils may sit, should be permitted in this age in any school," and he gives most excellent reasons for this advice. Improper chairs and desks, he says, "at which pupils are obliged to sit, the wrong postures which they are allowed to take in standing as well as in sitting, and the muscular fatigue caused by the inactivity of a great number of the muscles of the body for a long period, all these exist in surprising degree in a great majority of schools in this country, and they can be regarded in no other light than as causes of defective bodily deformities." Besides these obvious disadvantages of multiple and improper desks and seats, there is the increased danger of close contact between a healthy child and one suffering from some of the ordinary infectious disorders of childhood, and the unfairness of placing a clean

and healthy pupil at the same desk with a child suffering from some parasitic disease, the result of dirt and neglect.

This leads us to the consideration of the question of the exclusion from school of those pupils who are physically unfit for school and of those suffering from infectious disease or from any kind of disorder liable to be transmitted to other pupils. At the present time, in the absence of any medical officer acting on behalf of the school authority, the position is exceedingly unsatisfactory. The sanitary authority or medical officer of health has, it is true, certain duties and powers in this direction, but they are limited and incomplete. They can of course only be applied to those diseases of which the medical officer of health has official cognisance, *i.e.*, those coming under the operation of the Infectious Disease Notification Act, or when his attention is called to the prevalence of other diseases by the mortality returns or by information derived from the schools themselves. These powers are as follows:—(1) Schools or departments of schools can be closed for a specified time by the sanitary authority or by two members thereof acting on the advice of the medical officer of health, with a view of preventing the spread of infectious diseases, and for the same reason any scholar may be excluded from school. Information with respect to scarlet fever and diphtheria is of course available through the notification to the medical officer of health by medical practitioners, and in Cardiff and most other large towns a considerable amount of the time of the clerical staff of the Health Office is taken up in filling in and despatching certificates to the head teachers of the various schools for the exclusion of scholars from infected houses and subsequently for their return to school after recovery and disinfection. Those of us who have had the opportunity of watching the behaviour of epidemics of these diseases know full well that in most instances the onset may be traced to the attendance at school of unrecognised cases, and that their spread is favoured by the aggregation of large numbers of children at susceptible ages in school buildings. About 80 per cent. of scarlet fever cases occur at school ages. Diphtheria is essentially a disease of school manufacture. The investigations of Shirley Murphy show conclusively that in recent years there has been in London an increased mortality from diphtheria at school ages, as compared with that at all ages, and that the increased incidence of the disease upon the age period, 3–10 years, first became conspicuous in the year 1871, the year in which the Elementary Education Act first became operative. Further the effect of the school vacations was noticed, and it was found that there was invariably a diminution of prevalence corresponding to the vacation period,

and that the age incidence of the cases notified during the vacation altered; that is, the proportion of cases notified at school ages became less during the vacation, showing clearly that there is a greater opportunity of infection at school than at home. The behaviour of diphtheria in London corresponds fairly with that in most large towns and throughout the country. But as far as measles, whooping-cough, and chickenpox are concerned, the first intimation may be the presentation by the teacher of a long list of absentees, and a request for school closure. One of two things then may happen, the Medical Officer of Health may close the school on insufficient evidence, or may keep it open when it should be closed. He has no very exact method at his disposal for obtaining information as to the prevalence of these disorders in any particular locality. Frequently valuable help is obtained in these cases by timely intimation from school teachers. But this, after all, is an irregular, incomplete, and unsatisfactory arrangement; and, indeed, the teachers themselves can only have, for the most part, hearsay and second-hand knowledge of the cause of absence of scholars, derived usually from the reports of the attendance officers, or directly or indirectly from the parents of the absent child: in any case the information thus obtained is unreliable. Moreover, it is not the duty of the Medical Officer of Health to examine or inspect children absent from school on account of illness, and he has no power to do so. The position of a medical officer appointed by the Education Authority would in this respect be quite different. There are in addition several other affections which render a child more or less unfit for school life, such as chorea, contagious ophthalmia, errors of refraction, adenoid growths, pediculosis, ringworm, itch, tuberculosis, etc. The attendance at school of children suffering from these disorders is by no means unknown, and under the existing conditions can hardly be avoided.

We are all, I think ready to admit the possibility of injury, both to the child affected and to others, by school attendance in these cases, but as yet no comprehensive step has been taken to cope with the difficulty. With respect to one of the above-mentioned disorders, the Board of Education has done something: it has given advice. In 1901 the Board issued a memorandum addressed to managers and teachers of public elementary schools, calling their attention to the serious consequences which may result to the eyesight from the neglect of contagious ophthalmia, and recommending that teachers should be watchful with regard to this matter and exclude any child that is affected, taking care that he shall not be readmitted without a medical certificate of fitness. The

Board remarks further, "That in the matter of diagnosis the school authorities are confronted with a difficulty owing to the fact that a large proportion of the cases require special skill for their detection, and hence, unless expert knowledge is brought to bear, it is only too probable that many will be overlooked, to the detriment of children who may be subjected to unjust censure and punishment, as well as to the overtasking and further deterioration of the sight." Undoubtedly the local education authorities are confronted with a difficulty; a diagnosis of a clinical condition is expected, but there is no one to make it. The Board, however, ventures to make a suggestion for overcoming this difficulty, and finally remarks that "It is exceedingly pleased to learn that in one or two large cities a nurse is employed for this purpose," not, however, by the school authorities, but the Board believes that it is by voluntary associations, and that the school authorities may, if they like, take advantage of the nurse's services. Now, notwithstanding the many advances which have in recent years taken place in the status and education of the trained nurse, it is, I think, undesirable that she should be called upon to diagnose disease. Her training as yet has not that object in view. In most large cities and towns there are highly qualified specialists to whom the education authority could appeal. The visitation of schools, especially the infant departments, by suitable nurses, has many advantages, but its adoption by voluntary associations in one or two big towns does not in any way meet the case or relieve the education authority from its responsibility.

Assuming, therefore, that an improved system of medical supervision and sanitary control over schools is necessary, by what machinery can this be effected? Details must of course differ according to local conditions. A method which could perhaps be adopted with advantage in large towns might be unsuitable in smaller districts. A plan which works well in London might not be applicable to a town with two or three hundred thousand inhabitants. In this matter we must proceed with caution. Too much sanitary zeal and enthusiasm might defeat the object in view, and produce opposition and antagonism where co-operation and assistance are essential. A system of over-inspection by medical men armed with inquisitorial powers might produce a panic and seriously interfere with the discipline of the school. Undoubtedly the changes in administrative methods brought about by the new Act should greatly facilitate improvements in the direction indicated, and we have every reason to anticipate a bright future of gradual and important reform. A useful lead has already been given in the recent Report of the Royal Commission on Physical

Training (Scotland), which contains, amongst many other important conclusions, one to the effect that it is desirable that all schools should be under regular medical inspection. This, as Dr. Kerr has pointed out, is "the first official recognition of the necessity of medical knowledge and supervision in education."

Whatever system may be adopted it is in my opinion essential that there should not be two organisations having the same object. A dual authority concerned with the sanitation and medical inspection of schools would mean inefficiency and unnecessary expense. The practical unification of the educational and sanitary authority renders such dual authority unnecessary. I am not prepared to suggest that the medical officer of the sanitary authority should in all cases act as medical officer to the education authority. But in most large towns in which the health department is well equipped, a certain amount of medical supervision of schools is already exercised by the medical officer of health and the Public Health Acts and the Education Codes confer powers and duties upon that officer.

It is now his duty to inspect the schools in his district, but the action he can take as the result of this inspection is limited in the way I have already indicated. What is required in most cases, therefore, is the development and extension of the powers and duties already possessed. In large towns it is obvious that the medical officer of health could not himself undertake anything like a complete and systematic medical inspection of schools and school children. In some special cases, moreover, this work would obviously be more efficiently performed by specialists. His services should, however, be at the disposal of the educational authority for the purpose of advising upon the formation of a suitable scheme of medical inspection and supervision and for the general organisation and direction of the administrative details involved.

In conclusion I would quote the following from a very excellent leading article in the *Lancet* of 9th April:—"After May 1st the education of the whole country will be in large measure entrusted to authorities who have for many years been concerned, at least in some degree, with the public health, and who now have to deal in addition with public education. It is the primary duty of the education authority to teach the children something by which they may obtain the means to live: it is one of the duties of the sanitary authorities to teach the people how to live. It is therefore reasonable to hope that the sanitary authorities will not, in discharging their educational functions, lose sight of the functions for which they were established. There is now before the County Boroughs, and to some extent before the District Councils of this country, an

opportunity for work in a national and imperial sense which has never been equalled in their histories. They have now an opportunity of eclipsing, in a public health sense, all previous records."

Dr. Howard Jones (Newport, Mon.) stated that the large amount of money spent in this country in the attempt to educate children under five years of age was absolutely wasted; in fact, more or less permanent injury both to the health and mental aptitude of children was thus caused. This country was spending £1,280,000 annually on what was called the education of infants under five years of age. This sum he thought might be advantageously spent upon higher education, and medical inspection of schools and school hygiene. The school accommodation taken up by infants at present would be set free, and the necessity for spending money upon new schools obviated for some years to come, except in new districts unprovided for. He also referred to the great prevalence of measles and its high death-rate, etc., as being in a great measure due to the attendance at too early an age of children at school. The cleansing of schools was not what it should be. The floors, etc., were swept daily, and once every two months or so scrubbed out. The use of oil on the floor would, in the speaker's opinion, be a great improvement, as it would keep down the dust.

Dr. Herbert Jones (Hereford) referred to many instances in which school buildings had been built from plans approved by the Board of Education, but which were at variance in many particulars with the model suggestions of the Board. In connexion with these suggestions he pointed out that although lavatories and water-closets were recommended, no suggestion was anywhere made that water should be provided, either on the premises or within a reasonable distance, and stated that when he had called the attention of school managers to the absence of water from school buildings he was told that there was no regulation of the Board of Education requiring a supply to be provided.

Dr. Paterson (Cardiff) agreed with what Dr. Howard-Jones (Newport) had said as to the attendance of very young children at school. He thought that it would be very much better if the money now spent in attempting to educate very young children were spent in the establishment of gymnasia for schools. This, Dr. Paterson contended, could be done without any addition to the rates. The need for physical training in this country was very evident from the fact that of the number of young men from our towns who joined the army, a high percentage were rejected as unfit on medical examination, and of those who were accepted a large number were subsequently discharged as unfit for further duty.

Dr. Meredith Richards (Croydon) thanked Dr. Walford for his practical and well-timed address. It was most important that the new education authorities should have their attention directed to the opportunities afforded them for

improving the health of the next generation. He hoped that when ventilation was considered the necessity for raising the standard of floor-space in older schools would not be forgetten; many of these had only eight feet per child, though ten feet was obligatory in more recent schools. The medical supervision of school children was an exceedingly difficult problem. In his own district all cases of suspected communicable disease were reported to him. Most of these cases were visited by a woman health visitor (of whom Croydon had three), and efforts were made to induce the parents to seek medical advice. In the case of measles and whooping-cough, a leaflet was left at the house and its contents explained to the parent. "Swabs" were taken for bacteriological examination in nearly all cases of sore throat, either by the doctor in attendance or by one of his staff if there were no attendant. In this way many cases of ambulatory diphtheria were brought to light. With regard to furniture he imagined that the objection of the Board of Education to single desks was based on economy. Dr. Kerr's suggestion of continuous desks with single seats largely met the difficulty. He had some small experience of oiled floors. In a general office the process seemed to have lessened dust, but in a hospital ward it was very unpopular, as nurses found their dresses were stained by the oil.

Dr. Tatham Thompson (Cardiff) said that from three to five per cent. of the children attending school suffered from defective eyesight. The percentage increased right up to the university, when it was between twenty and forty per cent. Children generally were born long-sighted. It was in learning to use their eyes that the mischief was done: too close a vision and faulty illumination. The proper distance of the writing from the eyes should be not less than 14 inches, but if the "difference," that is, the distance between seat and desk, is great, so will the tendency for too close vision exist. On the other hand, the "distance" between form and desk in the horizontal plane is of extreme importance, for as the distance is greater so the body will fall forward for the arms to reach the paper, and the head will drop. For the erect position the "distance" must be nil, or better still a negative one of at least 2 inches. In other words, the front edge of the desk should overhang the front of the seat to the extent of 2 inches. If that is not done the child will try to slide forward on the seat, and lose proper support, being only perched on the edge, and the thighs having nothing to rest on. Another important point is the *height* of the form or seat. It should exactly equal the distance from the popliteal space to the sole of the foot, so that with the leg bent at the knee as a right angle, the foot can rest on the floor or foot-board. If not, the legs will dangle and tire, and the child will slip forward so as to rest the feet on the tips of the toes. The *absence of any back support* is another important point—without it a child will soon tire and cease to sit upright. The support should extend at least to the loins. Probably the next important factor in causation of defective eyesight is that of *imperfect*

illumination—it must be remembered that light decreases as the square of the distance, and that except in specially-constructed rooms there is necessarily a great variation in the amount of light available in different parts. In private houses I fear far too little attention is paid to this point, and it is beyond a doubt that the seeds of myopia are often sown in the lack of care in seeing that proper light falls on the lesson book. You all know that it is a common thing to see children squatting or lying, book on lap or on the floor, sometimes in such an attitude that one eye is considerably nearer than the other, and even with no more illumination than the flickering fire-light. Undoubtedly well-diffused daylight affords the best of all illuminants, and that in early lesson life, artificial light should if possible be avoided. If that is impossible, electric light or gas jets, well protected from draughts, to avoid fluttering, are the best substitute. Great care should be exercised in the colouring of the walls, so that the light should be diffused as much as possible. It might be convenient to parents to have their children under five at school, but educationally it was of no value. Single desks were an absolute necessity, and these should also be adjustable. The use of slates and slate pencils he condemned in a most emphatic manner, and also the slant writing, which he contended was conducive to defective eyesight and curvature of the spine. *Home lessons* are the bane of our present educational systems. It is no uncommon thing to find a child doing six or seven hours almost continuous school work expected to spend two or three hours over home lessons; then, moreover, under the worst possible conditions, when the mind and body are already fatigued, when no teacher is near to correct improper positions of attitude, and often with the aid of most imperfect illumination.

Miss Kate Hurlbatt (Aberdare Hall, Cardiff) said there was something radically wrong in the management of girls. Many entered college with defective teeth, impaired digestion, weak eyesight, anæmia, and headache. The value of fresh air was not recognised by parents. It was most important that as much time as possible be spent in the open air in order that real intellectual work could be accomplished.

Dr. D. J. Thomas (Merthyr Tydfil) said the adaptation of the older schools was one of the most pressing problems. In Wales they would have to depend mostly for their ventilation on natural methods. In very few districts would it be practicable to urge mechanical ventilation. It was admitted, that in naturally ventilated buildings, ventilation depended largely on diffusion, and owing to the slight power of diffusion which the spiro-toxins possess, the atmosphere became unwholesome at the end of an hour or so. To remedy this defect, the rooms should be emptied twice each morning and once in the afternoon, so as to flush the building with fresh air. To accomplish this object in all kinds of weather and without an undue interference with the teaching arrange-

ments, two conditions must be fulfilled; a central hall or a covered playground must be provided for each school, and the large class-rooms which are now a feature of the older schools must be abolished, smaller ones being substituted with a separate and independent entrance to each class-room from the central hall or playground. The smaller class-rooms would have other advantages: less strain would be placed upon the teacher's voice, and a better system of heating could be devised than the closed stoves which are at present in vogue.

Dr. T. H. Morris (Chairman, Glamorgan County Education Committee) said that the greatest brake on the progress of education was the Board of Education in London, and if any of those present could suggest any means whereby that body could be made alive to its responsibilities a great deal of good would be done.

DISCUSSION ON

FOOD AND MEAT INSPECTION.

Opened by Col. J. LANE NOTTER, R.A.M.C., M.A., M.D., D.P.H.

(Fellow),

And W. HUNTING, F.R.C.V.S.

(Fellow),

At Sessional Meeting, April 30th, 1904.

Col. J. Lane Notter.

THE systematic examination of meat and other food supplies is one of the most important duties devolving on sanitary authorities, and one too, which has for some time past engaged the serious attention of The Sanitary Institute. The report of the Royal Commission appointed to inquire into the effect of food derived from tuberculous animals clearly indicated that the danger is a real one, especially with regard to the meat of tuberculous bovines. The report was issued in 1898, and the Council of The Sanitary Institute at once acted on the suggestions therein stated, and established an examination test for candidates for the office of Inspector of Meat and other Foods; they formulated a syllabus for this examination which made the course of study and instruction as comprehensive and as practical as is possible, and they are indebted to the veterinary profession for the loyal support they have given them in carrying out this important duty.

Much misconception exists in the public mind as to what constitutes unwholesome meat, it being commonly held that meat of diseased animals is alone unwholesome, whereas, in truth, the possession of poisonous properties can be more distinctly traced to the putrescent state of meat from healthy animals than to the fresh meat of diseased animals, unless when the flesh happens to be infested by dangerous parasites. As the meat of diseased animals usually decomposes rapidly, it is not improbable that in many of the recorded cases of supposed meat poisoning, the effects attributed to the virus of the disease were really due to the putrescent condition of the food.

The advantages of a meat diet are: the large amount of nitrogenous substances, the union of this with much fat, the presence of important salts such as chloride, phosphate and carbonate of potassium, and iron. Meat is also easily cooked and is very digestible; it is probably more easily assimilated than any vegetable, and there is much more rapid metamorphosis of tissue in carnivorous than in vegetable feeders. The great disadvantage of meat is the want of starch.

The actual composition of meat is as follows:—

	Rump of Beef.	Shank of Mutton.
Water ...	74·2 ...	71·9
Proteids ...	22·0 ...	18·8
Fat ...	2·2 ...	8·3
Ash ...	1·6 ...	1·0
Total ...	100·0	100·0

Bone forms about 20 to 25 per cent. of the meat as sold. It is relatively more in young animals; in veal it constitutes as much as 30 per cent. Bones contain a large amount of nutrient matter, a considerable part of which is extracted by boiling, and more could be obtained if the bones were crushed. The following is the composition of beef bones:—

Water	12·1
Proteids	24·5
Fat	11·0
Ash	48·6
Loss	3·8
Total	100·0

Of these proteids nearly one-half (10·3 out of 24·5) are digestible.

Bones make a most palatable soup and may be made to yield an important addition to the useful proteids.

Good and wholesome beef or mutton should exhibit the following characters:—

1. It ought to be pale, slightly brownish, neither pale pink on the one hand, nor deep purple on the other. If pink, disease is indicated; and if purple, the animal has probably not been slaughtered, but has died with the blood in it, or has suffered from some acute fever.

2. It should have a marbled appearance from the ramifications of little veins of fat among the muscles.

3. It should be firm and elastic to the touch and should scarcely

moisten the fingers. Bad meat is usually wet, sodden, and flabby, with the fat looking like jelly or wet parchment.

4. It should have little or no odour and not a disagreeable one; for diseased meat has a sickly, cadaverous smell. Any disagreeable odour is most easily detected when the meat is chopped up and drenched with warm water.

5. It should not shrink or waste much in cooking.

6. It should not become soft or wet on standing a day or so, but should on the contrary dry on the surface.

The diseases of cattle which the inspecting officer should watch for are, (1) *pleuro-pneumonia*; (2) *foot and mouth disease*; (3) *cattle plague* or *rinderpest*; (4) *anthrax*; (5) *tuberculosis*; (6) *actinomycosis*; (7) *dropsical affections* from kidney or heart disease. A great number of other diseases attack cattle which it is not necessary to enumerate. The presence of *Tænia mediocanellata* cannot be detected before death.

The diseases of sheep are similar to those of cattle; sheep also suffer in certain cases from splenic apoplexy or braxy, which is considered by Professor Gamgee to be a kind of anthrax. Of the chronic lung affections from which sheep suffer, one of the most important is the so-called phthisis, which is produced by the ova of the *strongylus filaria*. This entozoon has not yet been found in the muscles and the meat is said to be good. The rot in sheep is caused by the presence of *distoma hepaticum* in the liver, and sometimes, too, by other parasites. The animal is supposed to take in *cercaria* (the embryotic stage of *distoma*) from the herbage.

The pig is attacked by anthrax in different forms, by tuberculosis, by muco-enteritis and by hog-cholera. The condition of the flesh is in most cases like that produced by septic disease, and it is unfit for human food.

The so-called measle of the pig, caused by the presence of *Cysticercus cellulosæ*, and the disease due to the *Trichina spiralis*, render the meat unfit for food.

Diseases caused by Meat.—The flesh of apparently healthy animals may produce poisonous symptoms; the eating of the flesh of the pig sometimes causes diarrhœa; no doubt the flesh is affected by the unwholesome garbage on which the pig feeds; in these cases the actual cause has not been isolated.

The flesh of healthy animals, when decomposing, often gives rise to vomiting, purging, diarrhœa, and great depression. Cooking does not appear entirely to check decomposition. The expulsion of the noxious food from the body generally results in speedy recovery, but the old and infirm may sink from exhaustion.

Sausages, pork-pies, and beef-steak pies sometimes become poisonous from the formation of a ptomaine. The symptoms are severe intestinal irritation, followed rapidly by nervous depression and collapse. Neither salt or spices hinder the production of this poison. The meat most likely to be affected is that stored in dark, damp, unventilated places, to which ground-air can gain access. Under these conditions the development of poisonous properties in the meat is largely increased.

And here I may observe on the absence of proper places for the storage of food, not only in the working-class dwellings, but even in the better class houses of the present day. Any dark unventilated corner for a pantry is considered to be sufficient provision, and a well-constructed and ventilated larder is not considered in the construction of these houses. There is no part in the construction of a dwelling of more importance than the provision of a proper place to store food, and yet the condition of many flats in London shows how totally indifferent are those who erect such dwellings to the necessity for such places. It would indeed appear advisable for the County Council to enact a by-law insisting on the provision of a proper larder in all dwellings.

The flesh, and not only the decomposing flesh, of diseased animals causes in many cases injurious effects. The probability now is that the effect of diseased meat will be found to be more considerable than was formerly believed.

At the same time we must not go beyond the facts as they are at present known to us, and at present certainly bad effects have been traced only in a few instances; perhaps the heat in cooking is the safeguard.

Meat is not apparently altered in the *early stage* of acute inflammatory disease, and it is said some of the best meat is taken from beasts in this condition; it is not known to be injurious, but the blood should be allowed to flow entirely out of the body and not be used in any way.

It is now accepted that *tuberculosis* in cattle cannot exist without the tubercular bacillus having been the exciting cause. Certain predisposing conditions may be present in the case of all animals, such as malnutrition, bad ventilation, damp soil, hereditary disposition, etc. The bacilli gain access to the body, either by inhalation of contaminated air, by inoculations or by ingestion of food containing the specific organism or its spores. These when swallowed adhere to the mucous membrane of the different organs, and they may then undergo further development; from the mucous surfaces they pass into the surrounding tissues and to the lymphatic glands, which largely become affected; after them the serous membranes of the abdomen and of the thorax are the most frequent seats

of the disease. Cattle, pigs, poultry, and rarely sheep, are all liable to be affected with tubercle, but it is in cattle, and more especially in milch cows, that tuberculosis is met with.

The organs most frequently affected are the lungs, liver, kidneys, and brain, and in the cow the udder. In cattle localised tuberculosis is the exception. The muscles appear to be rarely affected, although tubercle bacilli have been found in the expressed juice, which had infective properties: they have also been found in the blood and in the secretions of diseased organs.

In tuberculosis there may be no visible symptom of the disease in the animal, unless in the case of an acute attack, in which there is always fever and rapid wasting of the body.

When the disease attacks the external organs such as the udder, there is little or no constitutional disturbance; this is much more likely to occur when the internal viscera are affected, so that the animal may be extensively diseased and yet exhibit no symptom to call for special attention.

The question of the use of flesh of tuberculous animals has been much debated. From the nature of the case there is great difficulty in obtaining direct evidence of the transmission of the disease from animals to man. According to the experiments of Kastner, infection is not to be feared except in those rare cases in which tubercles are found in the muscles. On the other hand, experiments by Steinheil show that tuberculosis could be transmitted to guinea-pigs by administering the expressed juice from flesh in which no tubercles could be found.

Dr. Sidney Martin's evidence in particular before the Royal Commission on Tuberculosis (1898) shows that a great difficulty exists with regard to meat, inasmuch as a number of butchers are very careless in the cutting up of carcases partially affected with tuberculosis. Matter finds its way to the knives used, and this is transferred to joints which would otherwise remain untainted. Roasting before a fire was the least and boiling the most effective method of cooking the flesh. All evidence appears to show that when tuberculosis is present and well defined and when the glands are involved the flesh should not be eaten.

The recent outbreak of anthrax in Cheshire shows that this disease is one that calls for inquiry. It is well known that horse-hair and wool is imported into this country from Mesopotamia, Russia, and Asia Minor, and is received in a filthy condition; it has been the direct cause of woolsorters' disease to many operatives engaged in wool and hair factories. Up to very recently, and not, I believe, in all cases even now, has any general practice of disinfection been carried out, and the refuse

from the factories has been used as manure on account of its high fertilising properties. In this way outbreaks have taken place among cattle, etc. The facility with which anthrax can be communicated by actual contact with matter impregnated with the virus and the great rapidity with which putrefaction sets in after death proves that however good the meat may appear to be, it should be unhesitatingly condemned and destroyed, if evidence of the existence of anthrax is forthcoming.

Epidemic pleuro-pneumonia is a disease peculiar to the ox, and is a contagious inflammation of the lungs and pleura, but it has never been transmitted to other than bovine animals; its effects are localised in the lungs alone, and even in these organs the disease is a limited one. The rule has been to pass the carcases of animals slightly affected with pleuro-pneumonia as marketable and innocuous, if they present no departure from natural conditions.

Actinomycosis has been transmitted from cattle to cattle by inoculation; the jaws are usually the part affected. The most generally accepted view now is that the natural habitat of the ray-fungus is on the cerealia, that it lives on these parasitically, especially upon barley, and from these enters the animal's body through wounds, abrasions, etc.

As regards the preservation of meat we know that the blood and flesh of healthy animals are free from bacteria, but, on the other hand, the contents of the digestive tract are extremely rich in microbes.

If the carcase of a slaughtered animal be left without being disembowelled, the saprophytes will make their way through the capillary vessels of the intestinal wall into the general circulation, so that the entire carcase quickly begins to undergo decomposition. This can be prevented by the early excision of the entire length of the alimentary canal; and if this be practised the remaining flesh will be perfectly free from fungi. Any subsequent danger can only be due to gradual penetration from the surface. Since these sources of bacterial infection cannot be entirely cut off, attempts are made to prevent the increase of these parasites in the flesh. The oldest known remedy is cold, but the temperature must be kept several degrees below zero. The freezing of meat does not kill the germs present, but only hinders their development. If meat is not stored at a low temperature, but merely put in the ice-chest whereby it only attains a temperature of 0° C., an increase of germs ensues. These cold-supporting organisms produce the disagreeable taste and smell acquired by edibles remaining in the ice-chest for a few days. Actual putrefaction is not produced by these bacteria. Food-stuffs should not be brought into actual contact with natural ice, since this substance contains not only

putrefactive organisms, but also, under certain conditions, pathogenic organisms.

Frozen meat, when thawed, undergoes rapid decomposition, because the cellular tissue is loosened by freezing, and access to the interior is facilitated for any organisms present on the surface.

In dried and salted meat the development and activity of the organisms can be prevented by depriving them of the water necessary for metabolism. In salting and pickling it is only the hygroscopic power of the salt which comes into play; the germs are plasmolyzed and their activity so prevented. Tubercle bacilli are not killed by a concentrated solution of salt after two months' and typhoid bacilli after three months' action. Smoking forms a more reliable means of preserving meat, the active agents being the vapours of phenol, creosote, etc., present in the smoke. These antiseptics do not penetrate far into the flesh, therefore smoking can only preserve the fresh meat from healthy animals.

Milk.—By treating milk to a temperature of 60° C. for one hour, to 75° C. for ten minutes, and to 95° C. for one minute, tubercle bacilli if present will certainly be killed. Cholera and typhoid organisms are less resistant and are killed more quickly than tubercle bacilli at the above temperatures. Only a single pathogenic species can withstand the short boiling to which milk is ordinarily treated in domestic management, and this is the anthrax bacillus containing spores. The danger from this source is remote, as the microbe does not form spores within the animal body. Even in the worst cases, therefore, only vegetable forms, easily destroyed by boiling, can find their way into milk from the body of the cow.

The lactic acid bacillus, always present in unboiled milk (to which the souring of milk is due), is easily destroyed by heat; but the *bacillus mesentericus*, often found in it, forms spores, which are not destroyed by ordinary boiling and germinate when the milk is kept at a moderately warm temperature, producing a brisk fermentation whereby a large volume of gas is liberated. The fundamental idea of Soxhlet's method for sterilizing milk is to boil it for forty minutes in small bottles, holding just enough for one meal, and closing the same with an impervious stopper which is only removed just before use. Milk so treated will keep at the ordinary room temperature, as the spores of the *B. mesentericus* do not develop below 15° C.; but if it is introduced into the alimentary canal of a child, the spores will rapidly multiply, and in such cases large quantities of gas, giving rise to flatulency, will be formed, and possibly also poisonous decomposition products of albuminoid matter. To render milk

sterile in the strict sense of the word it is necessary to raise it to a temperature of about 120° C. for twenty minutes.

Under these circumstances the lactose decomposes into dark-brown fission products, the fat loses its emulsified condition and separates out as cream, which cannot be made to diffuse again even by shaking, and the proteids are converted into a form very difficult of digestion.

In short, there is at the present time the greatest difficulty for freeing milk on a large scale from germs without at the same time seriously prejudicing its flavour and nutritious value.

Since, then, the destruction of hardy germs is so difficult, the greater care should be taken by washing the udder, hands, and milk vessels, to secure extreme cleanliness in the preparation of milk intended for infant consumption.

Sterilization then becomes an easier task, the milk drawn under these conditions being very poor in spore-forming bacteria. It is imperative that the cream destined for butter-making should be free from pathogenic organisms. The organisms of cholera, typhoid fever, and tuberculosis present in butter retain their vitality for a long time.

As butter is consumed in the raw state, a reliable preliminary treatment of the cream is in the highest degree desirable. Schuppan has shown that it is possible to produce good butter from pasteurized or even sterilized cream, and Weigmann introduced the plan of artificially souring cream by means of pure cultures of *B. acidi lactici.* Boracic acid, salicylic acid, and even benzoic acid have been used as milk preservatives. The influence of small doses of boracic acid is still a moot point. One objection to allowing boracic acid to be added to milk is that it enables the milkman to palm off stale milk as fresh. It would, therefore, seem advisable to prohibit chemical preservatives altogether. In condensed milk many of the bacteria present are killed by the preliminary heating and the subsequent concentration at 50° C to 60° C. A few survive and are still alive in the finished product, but not in a condition to do any damage, since the high concentration plasmolyzes the germs, retarding their development and so preventing decomposition.

W. Hunting.

LEGISLATION has recognised the necessity for inspection of food of all kinds, whilst the seizures of bad food and the penalties inflicted on the vendors which are recorded daily in our newspapers, show that there is still much to be done in protecting the public health. Persons

engaged in the meat-trade frequently resent the action of inspectors, not always without cause. The protection of the public should not be irreconcilable with the interest of honest dealers, and increased strictness of inspection might well be attained without any injury or annoyance to these men. The great offender is not the reputable dealer, but the odd man who is ever ready to make a profit on material that no respectable tradesman would touch. Even a man of good standing may sometimes find himself in trouble through the carelessness or ignorance of his servants. It is also possible that men may be unjustly convicted for an alleged offence through the error of an inspector. The changes which convert good food into bad are sometimes not evident to the uninstructed, and sometimes are matters of degree, upon which two opinions may honestly exist.

The requirements of an Inspector of Foods.—An inspector should be not only a man of natural intelligence, but one possessed of technical training. At the present time there are inspectors wanting in both these requisites. Their actions are accompanied by hardship to honest traders, and encourage opposition to the carrying out of the law. Food-inspectors should supply some evidence of their efficiency, and the simplest method of doing so is the production of a certificate from a recognised authority stating that they have been tested and found capable. The Sanitary Institute now grants such a certificate, and holders of it should be preferred when local authorities are selecting candidates for the office of food-inspector.

The whole reason for the inspection of food is the protection of public health, and therefore with the medical officer of health must always be the ultimate decision of what is fit or unfit for human consumption. It is obvious that his other duties must prevent him from giving direct attention to all the details of food-inspection, and that he must have special officers to assist. To the sanitary officers, then, fall the duties of meat-inspection, and whenever doubt arises, or the law requires, the medical officer must be called in to advise or condemn. It cannot be expected that the sanitary officer should be a trained pathologist capable not only of detecting changes in food, but also of recognising their exact nature and qualities.

Most of the ordinary changes he should be able to detect at sight, with knowledge of their nature, but in some his power to detect will not be accompanied by exact diagnosis of the nature of the change, and then he calls upon his chief to decide.

To no one are the pathological changes which take place in domestic animals so well known as to properly-trained veterinary surgeons. The whole course of study and clinical experience of veterinarians is devoted to

this subject, and I venture to claim for them pre-eminence in the work of meat-inspection. Their attainments should be utilised, and when circumstances supply full scope for their powers and fair remuneration for their services, as is the case where large public abattoirs exist, I hold that the meat-inspection should be entrusted to them. There need be no conflict between their duties and those of a medical officer. All that is necessary is that an agreement should be come to as to what is fit or unfit for human consumption, and the veterinary inspector's decision may then be accepted.

The Difficulties of thorough Meat Inspection.—Outside of a public abattoir meat is distributed over private slaughter-houses, butchers' shops, and various factories where it is prepared for food in different forms. Thorough inspection should cover all these places, but we know that many escape notice altogether, and some receive only very irregular visits.

Then there is the facility with which meat may be moved by road and rail and delivered to unknown places. Owners of live stock have not yet distinguished between what is fit or unfit for food, and they have a not unreasonable desire to salvage all they can. Cows that appear to be approaching death from some disease are treated in the same way as those that suffer from a broken leg. Nearly every village contains a handy man who combines general dealing with horse and cattle slaughtering, and who is ready to dress and purchase the dead or dying animal. The resulting meat is sent to the nearest large town, and as often as not escapes inspection. Even the heavy penalties inflicted by the City of London Courts do not deter men from sending all kinds of pathological specimens to the metropolis as food for its inhabitants.

The only effectual method of controlling this irregular traffic is a regulation requiring that all meat sent by road or rail shall be consigned, or taken, to a central place for inspection before being delivered to any private person. All towns should have the power to make and enforce such a regulation.

Every slaughter-house should be licensed, and every person acting as a slaughter-man or dresser or carrier of meat should also be licensed.

What is fit or unfit for consumption?—This question should be answered as closely as possible. Of course, conditions will occasionally arise in which, with the food before them, two men equally capable may hold opposite opinions. The degree of unfitness must sometimes be a matter so fine that disagreement is allowable, but these cases will be few and far between if the general principles are accepted which shall determine what is fit or unfit for human food. Guidance is wanted for the owner of meat and for the inspector, and the men to determine are the medical officers

of health. Some uniformity of action is very desirable if inspection is not to be discredited. It is absurd that meat should be seized in one town which is passed in another. It is still worse when a certain definite condition is called unfit by one authority but fit by another. The methods of meat-inspection should not only be uniform, but the regulations governing them should be general. Imported foods and meats should be inspected as carefully as our home-products. It is obviously unfair to force a standard of excellence upon our meat-producers and dealers, whilst the foreigner is permitted to compete without any restriction whatever. It may be argued that the inspection of a cargo of beef or mutton would be such a tedious and expensive business as to be a hardship to the traders; but inspection need not include the examination of every carcase; every tenth or twentieth would soon determine the quality of a cargo; and the very fact of any inspection being enforced here would increase the rigour of the inspection adopted at the port of embarkation. The suggestion of the Local Government Board that all stripped carcases should be seized is insufficient, some examination of the lymphatic glands should be added.

By way of inviting discussion as to unfitness of meat, I offer a few remarks on some conditions which are believed to be deleterious.

Putrefaction.—This is the most common cause of unfitness for consumption. It is, however, a matter of degree and must be left to the discretion of the inspector.

Emaciation.—As this condition usually depends upon disease, its presence may nearly always be accepted as evidence of unfitness. But when viscera are healthy, and flesh and fat firm, there is no reason to object to mere leanness. I remember three carcases of sheep being seized in Smithfield which I saw during life and while being dressed. Healthier animals I never saw, but they were seized simply as "being too lean."

Inflammations.—A simple inflammation of any part or organ of the body renders the affected part unfit for food, but does not afford reason for condemning the rest of the carcase. Septic and specific inflammations may result in no apparent changes, except those local ones which would entail condemnation of the affected part. Suppuration, when present, is more serious, but may only be local.

When an inflammation has not caused general changes in the carcase, when the flesh is firm and of a good colour, I think it may be treated as a local matter. When the flesh is dark, wet, and soapy to the feel, the whole carcase should be condemned.

Specific Diseases.—The Diseases of Animals Acts have scheduled a

number of the specific diseases of cattle, sheep, and pigs, so that legally, none of these should ever come under the notice of meat-inspectors: they are otherwise disposed of. No doubt many carcases of animals suffering from rinderpest, pleuro-pneumonia, and foot-and-mouth disease, have been consumed by human beings, but no injury has ever been traced to such a proceeding. Quite recently, carcases of cattle suffering from anthrax have been consumed and no trace of injury has been recognised. Pigs suffering from swine-fever are common, and it cannot be doubted that many have been sold for food and consumed without injury.

In all the scheduled diseases seizure should follow detection, because such carcases are illegally offered for sale. Fortunately, the chief contagious diseases of cattle, sheep, and pigs, are not transmissible to human beings, and therefore not likely to do any harm even if the carcase were offered for sale.

Diseases of animals transmissible to man are rabies, glanders, anthrax, and tuberculosis. These, therefore, require some consideration.

Rabies has been stamped out in this country for nearly three years. The danger to human beings from a diseased carcase would be greater to the butcher than to the consumer, but as all affected animals are provided for under the Diseases of Animals Acts, they should be seized. Unfortunately, there are no definite post-mortem lesions, and diagnosis could only be made from a correct history or by means of inoculation from the nervous centres.

Glanders does not affect cattle, sheep, or swine. It is almost confined to equines, but is communicable to man. Horseflesh is so seldom used as food here that we might ignore the disease, save as possibly present in some prepared foods. At present the compensation paid for affected animals renders their use for any purpose outside the regulations of the Diseases of Animals Acts very unlikely.

Anthrax.—This disease prevails widely among cattle and is increasing, according to the Government returns. Although many carcases of diseased animals must have been consumed, and apparently with impunity, there is no disease which is more unanimously banned by all authorities.

Tuberculosis.—Until the positive evidence obtained by some experimenters that bovine tuberculosis is transmissible to man is shown to be erroneous, we must assume that tuberculous carcases are unfit for human consumption. There is, however, a stage of the disease which may be accepted as purely local. In such cases all the unaffected portions of the carcase may be passed as good food. I accept the suggestions of the Royal Commission as to what states of the disease render the carcase fit

or unfit for consumption. If uniformity of action be desirable, the Commission's recommendation should be accepted.

Actinomycosis is a local disease although it may affect more than one part of the carcase. By interference with some important function it may produce emaciation, and the general symptoms resulting would have to be judged as in any other local disease. When the carcase is firm, slight actinomycosis may be treated simply by condemnation of the organ affected, with, perhaps, the immediately contiguous tissues.

Parasitic Diseases.—Very few of the parasitic diseases of animals used for food are transmissible to man. In those which are not, the carcase may be accepted as fit for food, save the special organs affected.

Fluke in sheep and cattle necessitates seizure of the liver, but the carcase is fit for food unless it presents changes due to constitutional disturbance.

Echinococci and other cystic forms of parasite render the affected organs unfit, but do not necessarily spoil the carcase.

Measles in pigs and cattle renders the carcases unfit for sale, although a few days' freezing or thorough cooking prevents any injury to man.

Trichinosis is almost unknown here, but renders carcases in which it exists unfit.

Strongyli in calves render the respiratory organs unfit, but do not affect the carcase unless the disease has been so virulent or long continued as to produce changes in the flesh which are noticeable.

In the larger towns, where abattoirs exist, meat-inspection is very thoroughly done, so far as the abattoir is concerned. But meat may be killed outside the urban boundary and brought in with no certainty of anyone seeing it, save the butcher and his customer. Some kind of clearing-house is needed, through which all meat killed outside the boundary should compulsorily pass.

Probably the most dangerous and offensive meat is used only for manufacture into prepared foods, and therefore these manufactories should be regularly inspected. All places where meat is prepared or sold for human consumption should be licensed and open to inspection.

Dr. H. E. Armstrong (Newcastle-on-Tyne) said although he was not in entire agreement with all that had been advanced in the two papers, he was very largely in accord with most of the views expressed by Col. Notter and Mr. Hunting. There were several points not touched upon that he would like to

have seen dealt with. One, for instance, was the question of the Tuberculosis Compensation Bill. Mr. Hunting had given him an opportunity of alluding to the inspection of foreign meat. We received a large quantity of foreign meat in this country, which was fortunate; probably we were going to get a larger supply in the future than in the past, especially, perhaps, from Argentina. It was important, as Mr. Hunting had pointed out, that meat should not be sent from abroad to handicap honest trade here. But the importance of carrying out the inspection efficiently was very great. Dr. Collingridge could speak more authoritatively on this matter than himself. The suggestions which had been thrown out did not seem to meet the difficulty, and the greater the difficulty the greater was the need for trying to surmount it. Foreign meat was sent to us in various conditions; it was, too, all sheeted, and he did not think that the inspections of a carcase here and there among several thousands was an adequate or proper examination of such meat. Because one carcase was good it did not follow the whole cargo was uniformly good. This was assuming too much, but it was the practice to which they seemed to be driven at present. There should be an organisation to go further than that. Offal, for instance, came in boxes, and no information was obtainable as to the prevalence or otherwise of tuberculosis in the carcases to which it had belonged. The foods from the United States came stamped. But the stamp said nothing about the quality of the meat sent. Perhaps it was sent without any examination of the glands having been made. Sometimes the carcases came with the pleura removed. Not long ago there was a case in Newcastle of a carcase from which the pleura had been removed and in which the glands were beginning to undergo changes, only found out upon examination. The flesh was seized and destroyed with the consent of the consignee. The facts indicated a very imperfect way of dealing with such matters. With regard to the rules for the seizure of tuberculous meat, he thanked Mr. Hunting for his very fair exposition. He quite agreed that meat inspection should be under the control of the Medical Officer of Health. He would like to see one uniform method adopted in all towns. That was probably a more difficult thing to obtain than the mere examination of all carcases of beef from America, because opinions varied among Medical Officers of Health. After long experience he was of opinion that the term "tuberculous meat" should be more clearly defined than it is. What is at present so called, is meat with *visible* tubercles on, or in, it; but long before the disease became visible the meat was tuberculous. This fact was well known to bacteriologists, but in the trade it was lost sight of. If that fact were fairly grasped, then the moment a piece of meat became visibly tuberculous to even a small extent, it should be dealt with, because the visible tubercle was the sign of the invisible tubercle or microbe, and was a proof that something had been going on in the tissues and juices of the animal for a considerable time before the visible home of the tubercle bacillus had been built for it. One of the greatest difficulties that beset inspectors and medical officers was that of getting prosecutions, even in cases of very bad meat

sent in from the country, because of some technical point or other. In one instance under his observation the assistant meat inspector and the manager of a sale depot were standing together when a cart arrived with carcases from the country, some of which were good, but one was highly tuberculous. The meat was not actually delivered. The diseased carcase was taken possession of and destroyed, but in view of recent decisions it was considered by the Town Clerk not to be a good case in which to take legal proceedings, although the disease was very extensive. The fact of the meat being found whilst still on the butcher's cart constituted the technical difficulty. Col. Notter had drawn attention to a very important point in regard to the carelessness with which butchers use their knives in cutting up carcases. The speaker made it a duty to try to teach butchers the great dangers they themselves run (not to speak of their customers) in not being scrupulously clean, and to urge them as far as possible to sterilize their knives after use in cutting up tuberculous meat. He thoroughly agreed with Mr. Hunting as to the difficulties of meat inspection outside abattoirs and also to the need of a clearing house.

DR. W. A. BOND (Holborn) said that after being appointed medical officer of health for the Holborn District Board of Works, it was suspected, and he confirmed the suspicion, that a large amount of very much diseased meat was being introduced into that district, meat that was quite unfit for food. There were great difficulties in the way of inspection, because meat was brought into that district very early in the morning. It was practically impossible for officers engaged on day duty to be up at that time. It was therefore essential that a meat inspector should be appointed, and they were very fortunate in securing the services of Inspector Billing, who was no doubt well known to them all. The result was that during the year following the appointment he had to attend various law-courts between 120 and 130 times. He also read a paper before The Sanitary Institute on "Public Abattoirs," and on the great difficulties there were in the way of a satisfactory meat inspection. As far as London was concerned he felt it was necessary to have public abattoirs, which could be supervised by veterinary surgeons, who had more knowledge of animals than a medical officer of health. He quite agreed with Mr. Hunting that uniform standards ought to be laid down, and that medical officers ought to come to some uniform decision with regard to difficult points. He was therefore glad that the Royal Commission on Tuberculosis had laid down general rules for the seizure of tuberculous carcases. Even before the findings of that Commission he had always practically acted upon those lines. Another point with regard to the seizure of carcases was that if there was evidence that the animal had not been properly bled, it should be seized; because in such cases there was little doubt that the animal had been dead or about to die before it was prepared for food. He was glad to hear Dr. Armstrong emphasise the point raised by Col. Notter as to the knives, a point which had also been dealt with in Dr.

Sidney Martin's evidence before the Commission. In connection with anthrax, all refuse from factories should be sterilized before it was made use of for manure. That was a point that ought to be strongly emphasised. Mr. Hunting stated that all places where meat was sold or prepared for human consumption should be licensed and open to inspection. He thought that under sec. 47 of the Public Health (London) Act, 1891, they had ample powers for inspecting meat in all premises in which it was sold or prepared for sale, and there was a similar section in the Public Health Act, 1875, which applied to the whole of England. There was one point in Col. Notter's paper which had struck him forcibly, viz., the question of the provision of proper larder accommodation. That was so important that he would suggest that it be made the subject of a special resolution of that meeting, and if no one else proposed it, he would be happy to do so.

Dr. T. Whiteside Hime (Bradford) said he was glad to bear his tribute to the great value and importance of the papers that had been read, and he trusted it would not be considered out of place if he ventured to differ from Col. Notter and Mr. Hunting on one or two points, and that his criticism would not be taken as implying any lack of appreciation of the value of their contributions to subjects brought forward by them. Mr. Hunting had commenced with the statement that the legislation of the country dealt with all kinds of food. He wished it were so; but there was one important article of food which was not affected by the law, because the law had taken the trouble to exclude it specifically, and that article of food was water, one of the prime necessaries of existence. For some inscrutable reason water had been excluded from food legislation. The interesting points raised by Col. Notter and emphasised by Mr. Hunting in regard to putrescence ought to be laid to heart by all, especially by those wishful to become inspectors, because these points were usually very much lost sight of. The tendency was to hunt for the presence of one of the specific diseases, such as tuberculosis or anthrax, of which there might be no evidence, the decay and putrid condition being regarded as of little or no importance. There was one noticeable and very remarkable difference between the two papers that had been read. Col. Notter seemed to have directed his attention more particularly to the scientific aspects of the question under consideration, and to high and rather fanciful ideals. Col. Notter considered that meat is not fit for use under various conditions, which Mr. Hunting considered should not prevent meat from being passed as fit to be consumed. Here were two authorities at variance, without any question of getting a legal verdict being raised, or any possibility of suggesting prejudice. The evidence upon which a great deal of meat was condemned as being unfit for food was often dependent on the feeling, or prejudice of the individual. When a question of degree arose there would unavoidably be difference of opinion in some cases. But where there was scientific evidence of facts, mere opinion should not decide important questions. For

instance, it was considered desirable in nearly all cases to condemn the carcases of animals drowned, or had suddenly died, or had not been properly bled. He did not think that any sufficient grounds had been advanced to them for that procedure, or proof given that such meat was unfit for food. It was on account of the condition of the meat, and not on account of the violent death that it should be passed or condemned. If the meat was bad it should be condemned, and if good it should be passed, regardless of the mode of death. Or to take another instance, the condemnation of a whole carcase because there had been found some animal parasites in the intestines, which are wholly incapable of living within the human body. That was not altogether a rational proceeding. Mr. Hunting took the same view as he did, the other view was not supported on any ground. Take for instance *pâté de fois gras*, a relish derived from a diseased condition of the liver, and often artificially produced by subjecting the animals to unnatural and unhealthy conditions of life. That was eaten all over the civilised world, and no one had ever suggested that there was any danger in that delicacy. He could not see any sound reason for supposing that the presence of intestinal worms in animals, which could not develop in the human being, should be regarded as a reason for condemning the carcase of the host. If the host had suffered in health from the long continuance or great number of the parasites, then the unhealthy carcase should be condemned. Col. Notter made reference to a matter to which he thought attention ought to be prominently drawn all over the country, the condition of pork. The pig, as a rule, got nothing but food of the most stinking character, and though naturally a cleanly animal was obliged to live in filth. It was highly desirable that general attention should be directed to this subject. Could the flesh of animals born in filth, fed on filth, and reared in filth be regarded as wholesome and good? He doubted it. He did not know whether any legal power existed whereby medical officers and inspectors could interfere in this matter, but there were a great many things in this connection in which action could be taken with advantage, and much could be effected, even where there was no legal power to act. By advice and assistance the public officers might do a great deal to assist towards securing better conditions of keeping, feeding, and fattening pigs. It was to be regretted that time prevented the speakers referring to other kinds of food. Of course, the most important question of all was the vexed one of tuberculosis. Col. Notter used a very sweeping phrase when he stated in his paper that "All evidence appears to show that when tuberculosis is present and well defined and when the glands are involved the flesh should not be eaten." He ventured to take very great exception to that statement as to what "All evidence" shows; in fact, he did not know where the evidence referred to as warranting the alleged conclusion existed. He would recommend every student to study for himself the Report of the last Royal Commission and see for himself what evidence there was. The remark as to "tuberculosis being present and well defined," he did not think meant anything whatever,

because if it was present so as to justify condemnation, it must be "well defined" and clear and obvious to the eye. As to "the glands being involved," did that mean that the whole carcase was to be destroyed if there were one or two glands in the whole body affected? As the statement stood in Col. Notter's paper, it was so. He doubted whether Col. Notter could have meant that; if he did then Col. Notter differed on this point from all other distinguished authorities. As they might know, the Local Government Board did not hold that view, and had issued a set of model by-laws in which it defines conditions in which it is quite right and proper for the sanitary authority to pass carcases where tuberculosis is present, and which are practically identical with the rules in force all over the Continent and in America. He believed that every medical officer in the country, except one or two very extreme men, adopted those rules in practice, though, unfortunately, these model regulations did not seem to be formally adopted as by-laws. He thought that no medical officer in the country adopted what seemed to be Col. Notter's rule that if "glands were involved" the whole carcase must be destroyed, what the French call "*saisie totale.*" No government in the world sanctioned it. Take the every-day experience in hospitals. Operations were performed on persons with tuberculous glands of the neck; they were removed, and the wound healed up, and the patients returned to a perfectly healthy and normal life. Yet they were asked to believe that because a gland in an animal was infected, the whole carcase was infected with tuberculosis and must be condemned. No person of authority believed that. It was not the view of army medical officers, nor of the Royal Commission, nor of the Local Government Board; nor was it the practice of medical officers or inspectors throughout the country generally to act on it. Dealing with foreign countries, he pointed out that the inspection of butchers' meat is carried out in some of them with a degree of care and by means of officials who have undergone a system of scientific training that is unusual in this country. He thoroughly endorsed the view that had been advanced as to the necessity for having only well trained and carefully educated meat inspectors, that men should be thoroughly qualified before they undertook to exercise the tremendous powers they possessed under the Public Health Acts to interfere with private property, ruining possibly not only a man's trade but also his character. The powers were very large, and ought only to be entrusted to persons of considerable special knowledge and large experience. He was not referring to the large cities where the medical officers were trained men and gave their whole time to their duties and generally had well-trained inspectors under them, but to the great area of the country where inspectors had to fill up their time with many varied functions, in fact, all imaginable duties, and medical officers got a few pounds a year for casual attention to the very responsible and im-portant powers they held under the Public Health Acts. He thought they would all agree with him that no men should be allowed, without proper

qualification and training, to carry out the important duties of meat inspection under the Public Health Acts.

Dr. R. Sydney Marsden (Birkenhead) said that Dr. Hime had raised one of the most important subjects with which many of them would have to deal when they got into practical work. That question was how far a carcase could be diseased by tuberculosis, and yet be judiciously passed. He begged to differ from Dr. Hime when he said that the majority of medical officers of health take the view which Dr. Hime did, because it was his experience that Dr. Hime was frequently opposed to medical officers in their action for the condemnation of tuberculous carcases. Therefore it could not be true that they were all agreed on the subject. At the same time, what Dr. Hime said required very careful consideration from a practical point of view. Unfortunately, the medical officer of health had not the decision of the matter. They had to go to a magistrate (often without special knowledge) to issue a condemnation order, and magistrates frequently would not believe what they were told by scientific witnesses unless visible evidence were produced in support of the contention. And this cannot always be done, hence the difficulty. The question often arises, how far the disease may be localised, and no word is more abused than this in regard to cases of tuberculosis. He once heard an expert witness of considerable distinction say that although the disease was in 24 different glands of a body of beef, distributed from the neck to the pope's eye, the disease was *localised* in the glands; the inference being that it was a case of localised disease; the carcase was riddled with tuberculosis, and yet they could have this assertion about localised disease. He was not one of those who denied that localised tuberculosis could exist, it frequently did; but it depended upon the source of infection, the mode of entrance into the tissues, and how far the bacilli have travelled before they have been filtered out. One of the difficulties they now had to meet was whether they could have a fore-quarter of beef affected and the hind-quarter not affected. They would have to fight that out with the butchers and in a court of law. Dr. Armstrong said if there were five nodules on the pleural surface and in the glands of the thorax and chest, condemn the whole carcase. He was not so certain that Dr. Armstrong was not scientifically right. But if the hind-quarter were cut off from the fore-quarter, and thus made into two distinct pieces, how were they going to deal with them? Practically, they could not deal with them, and they could not get out of the difficulty because they had to go to a magistrate who would want ocular demonstration of the disease in both pieces. Now, there were one or two statements in the papers which he would rather like to reconstrue, because otherwise they might mislead. Col. Notter said that good healthy meat should be firm and elastic to the touch and should scarcely moisten the fingers. "Bad meat is usually wet, sodden, and flabby, with the fat looking like jelly or wet parchment." He took

exception to that description; bad meat might look like that, but it did not frequently look like that; it must be in a very bad state to reach that stage. Then Col. Notter said diseased meat has a cadaverous smell; but there is much diseased meat which has no cadaverous smell. Then Col. Notter laid stress and importance upon *filarius strongylus* or pseudo-tuberculosis, which is a very common disease among sheep. Dark spots were found on the lungs, which often gave rise to considerable trouble in the minds of the inexperienced inspector; they thought they had got a tubercle, and yet the appearances did not quite correspond. *Filarius strongylus* rarely does any harm; Mr. Hunting stated the conditions under which it does harm. There was one important section of meat inspection which had never been properly studied and was not fully carried out (he thought Mr. Hunting would agree with him) and that was in regard to the inspection of the pig. If there was one class of animals used for food subject to diseases of all kinds it was the pig. Very often it was difficult to tell what is the exact cause of complaint in their case. A pig might be seen to be feeding in an apparently perfectly healthy condition in the evening, and before the next morning it would die suddenly. Then they had to decide from the carcase what had happened. Pigs were subject to all sorts of conditions due to shock; there was one condition of the pig known as "shot," viz., small hæmorrhagic patches all over the pleura and in the tissues, especially of the tissues and the muscles down the back-bone, which have little hæmorrhagic patches through them. Those patches could be produced by shock, and also by blood diseases, such as purpura hæmorrhagica, and the difficulty sometimes was to distinguish between them. Those were the kinds of questions they had to determine. Why do pigs so frequently suffer from all kinds of diseases? It was because they were given all kinds of filth to eat, sour food and rotten swill, anything was good enough to throw into the pig tub. The pigs ate this food and it produced inflammation in their liver, irritation of the alimentary tract, irritation in the kidneys. If there was an irritation in a vital organ of that description, then there would be changes in the flesh, and therefore one ought to be very careful to see the organs in any case of pig disease. Another important question was raised by Dr. Armstrong in regard to tuberculosis in frozen animals. At Birkenhead he (the speaker) perhaps dealt with the largest meat supply in England. His average during the last twelve years had been 220,000 per annum of American cattle. This came in as fresh meat and did not come under the catagory to which Dr. Armstrong referred, but still, he would like to remark that when Dr. Armstrong said that the carcases were wrapped up in cloths and that more severe inspection ought to be made of this frozen meat imported at the present time, Dr. Armstrong did not say how it was going to be done, and there was some difficulty in it being efficiently done. It ought to be delivered at a depôt and thoroughly examined. Dr. Collingridge would probably tell them how he got over that difficulty of covering cloths, which appeared to be a difficulty at the start. The carcases

were delivered in cloths and the quality of the cloth was a practical and a very good index as to the place whence the cattle came. River Plate carcases have woollen cloths, Australian have cotton ones. The woollen cloths stretched in all directions. Cotton cloths would not stretch like woollen ones. But if they were to deliver carcases about the country and stripped off the cloths at the port of entry, then delivery in good condition would be prejudiced and they would have the whole butchering trade against them. Dr. Hime raised the question as to whether they should condemn drowned beasts or beasts strangled or anything of that kind. He thought Dr. Hime had raised a difficult point there. They would bleed a carcase and make the blood into a black pudding and eat it; but would it do them any more harm if it were left in the carcase or in the meat? Will it or will it not? That was the question. He was not prepared to answer the question straight away, because he had not hitherto looked at it from that point of view. But when an animal had been drowned or strangled it had gone through a preliminary process of excitement and fever; that excitement or fever would have produced changes in the physical condition of the blood and flesh, and this he had always understood to be one of the reasons and a sufficient justification for condemning such carcases, irrespective of chemical changes in the blood itself if allowed to remain in the body. He could not agree with Mr. Hunting as to the method of examining large consignments of frozen carcases of meat, viz., that if one in twenty were examined that was to be held a reasonable examination. He did not think that was a sufficient examination. It was the one in ten or twenty that would always pass. It was easy enough to have the animals hung up in rows, and any expert could easily pass 3,000 carcases in 3 hours, because the healthy carcase would be perfectly obvious to the trained eye; it is the one that deviates in the slightest degree from the normal that at once attracts attention. They would be astonished to see how a trained inspector would pass along a long line of carcases and pick out the one that is diseased. One other word in reply to Mr. Hunting's statement as to inspectors. Mr. Hunting and himself had always differed on this point, whether a person who is to be a meat inspector should be a trained veterinary surgeon or not? Of course, they would all agree that a veterinary surgeon should know the work better than anyone else. For inspection under the Contagious Diseases of Animals Act he was the only proper person. But when they came to the dead animal and to a trade which has tricks of its own, his belief was that a well-trained ex-butcher was best, such a man with a good knowledge of diseases would make the best inspector, for this reason, that a veterinary surgeon was a man in a different position in life, he could not go and do the rough work which the ex-butcher would do; he would not go pressing among the carcases and offal and the pickling tubs, and fetch the things out, and when he has got them in his possession carry them away with him in his pocket or in a sack under his arm. The inspector must seize diseased meat when he got the chance, he could not leave it, and therefore an inspector of meat must be in a

position to cut and take what he sees. If there was any question about the pathological condition, then it seemed to him they did not want both a veterinary surgeon and a medical officer as well. They were both trained pathologists, either ought to know the business, and one was sufficient. If there were two men knowing their business and they did not agree, then under which master were they to serve? There would be constant struggles going on between the parties. Mr. Hunting said the medical officer must decide, but could Mr. Hunting guarantee that the future race of veterinary surgeons would accept that view and that position? He saw a rock ahead. If they were going to have one supreme head, his authority must be retained. He for one would never be prepared to give up his powers of deciding pathological questions to his veterinary inspector. He had the greatest respect for him in all that touched the Contagious Diseases of Animals Act; he did not profess to know anything about the subject of disease in live animals; but when it came to a question of pathological change, he must decide in his own province and no one else. He would have liked to speak on the subject of the different diseases caused by inflammation, but time would not permit, and it was impossible to cover the whole ground of meat inspection in one short discussion.

Lieut.-Col. J. A. Nunn (Army Veterinary Department) observed that the papers had been thoroughly discussed, but there was one point in Mr. Hunting's paper on which he would like to say a word, and that was in regard to the training of meat inspectors, and the course of instruction given by The Sanitary Institute. He had been through this course and had obtained the certificate, even after he had been twenty years a qualified veterinary surgeon. The impression that was abroad that anyone could come up and get the certificate of The Sanitary Institute was absolutely erroneous. The examination was a very stiff one, and anybody who passed it was, in his opinion, perfectly qualified to carry out an inspector's duties. Several questions had been raised that morning as to the advisability of condemning carcases that were only partially diseased, or of animals that had been drowned or strangled. The present position seemed to give rise to a good deal of dissatisfaction in the meat trade. The difficulty had been got over in Germany by what is called the "Frei-bank" system; under which the carcase is condemned as not being first-class, but not as being dangerous to health or unfit for food; the meat is disinfected, sterilized, and then sold on the "Frei-bank" as second-class meat, and it is largely purchased by the poorer classes of the population. The subject of dirty butchers' knives had also been brought forward: in England it was a crying evil, in Germany it had been legislated for, and in the public abattoir of Munich the knives were all metal-handled, and have to be sterilized before they can be used on a second carcase. A point which to his mind required consideration at the present moment was, that there is now and will be in the future a large importation of foreign meat into this country; and in foreign countries there are diseases that

are unknown in these islands. Only the other day the report of the Agricultural Department of New Zealand was sent to him, which contained an account of a disease, called epizootic mammitis in cows, which, he believed, had never been seen in this country. Another point which had not been touched on was the putrefaction of salt meat when it was hurriedly prepared, as it was by the injection of preservatives; the animal was killed and the ham or bacon packed within twenty-four hours. The question of the deterioration of the flesh was one that should be considered. Mr. Hunting was a member of the same profession as himself, and naturally he agreed with him that the veterinary surgeon is the proper person to carry out the inspection of meat. In the French Army the veterinary surgeon was the inspector of meat and animal food, and the medical officer was the inspector and authority for other foods. In England they must allow that there was very little systematic arrangement of meat inspection; in fact, the inspection of it at all was a latter-day product. On the continent the inspection had been carried out for a much longer period and was much more thorough. In Paris and other large French towns, as well as in Berlin and St. Petersburg, private slaughter-houses were forbidden and Government abattoirs were established; the three he was acquainted with are most elaborate and efficient, checking effectually the palming off of diseased meat on the public. In England we had not arrived at this stage yet, and as long as private slaughter-houses are permitted he failed to see how proper safeguards could be carried out.

Dr. Collingridge (City of London) thought it must be admitted that the only proper solution of the problem of meat inspection was the provision of public abattoirs. He looked upon the question of whether the veterinary surgeon or the medical officer should be the judge of meat as a question that is absolutely settled. The veterinary inspector is, in his opinion, the only man who is capable of judging as to the condition of a live animal; when the animal had passed into the carcase form then the question was entirely one for the medical officer to deal with. The reason why animals not properly bled are condemned is because the blood decomposes very rapidly in the body of the animal, and therefore the whole carcase speedily commences to putrefy. That was the main reason, and probably the only one. With regard to the question of the tubercle, it was all very well to discuss it from the academic point of view, but the work had to be considered from a practical point of view. There was ample evidence to justify the requirements of the Local Government Board as set out in the circular to which reference had been made. It was on that circular they would have to act, and by that circular they would have to stand; there was sufficient evidence for that opinion. (This has since been confirmed by the Interim Report of the Royal Commission on Tuberculosis.) He thought it was sufficient for the practical carrying out of the work of meat inspection. Some question was also raised as to the localization of tuberculosis in the human being and the suggestion that

the human being could be cured by treatment. He desired to point out, however, that the evidence of cure in the human being was foreign to the subject; it was after all a matter of inference and assumption. They were not prepared at any time to say that tuberculosis had been absolutely cured; and, moreover, there was the very practical point, that while the human being is under treatment for tuberculosis in any shape or form, the conditions of life, the surroundings, the food, are all carefully provided for, conditions which obviously do not obtain in the case of the lower animals. The question of frozen meat had also been dealt with, and the possibility or impossibility of inspecting every single carcase had been insisted upon. The same question applied to the inspection of fresh meat on a large scale in markets. The proper place for the inspection of meat was at the slaughter-house, at the time of slaughter, when all the materials which were necessary for forming an opinion were present. It was very hard indeed to call upon a man to give an opinion as to whether an animal was fit for food when he had not the full material present to judge by, *i.e.*, he requires all the organs. They were only presenting him with half the case in asking him to pass an opinion on trimmed meat. Fortunately there was very little disease in frozen meat as we receive it, practically there is hardly any ever found; that fact, at any rate, gave the answer to one of the questions which had been raised. Then although the condition of the wrappers was no guide with regard to disease, with regard to the condition of the animal, *qua* putrefaction, it was of much assistance; they could be perfectly certain if the covers were clean they had not got the question of putrefaction to deal with, nor thawing. As to the stripping of the carcase, he quite agreed that it was not necessary to examine every animal; those animals were produced in batches, they were killed in batches, and they were shipped in batches, and they could be inspected in batches. Each of those batches represented the product of some particular place, with the same conditions obtaining in the case of all of them. It was therefore only necessary to keep a general supervision over these animals, and to inspect a certain number. It was quite possible, as had been said, that an unsound animal may be passed. There was no inspection possible or practicable on a large scale which would absolutely preclude the possibility of one single unsound animal being passed. That was a counsel of perfection to which they did not attempt to attain. To even attempt to attain to it would involve a great deal in a market he knew, where 4,000 tons of meat a day went through. It would require a considerable staff of inspectors, and whatever the number of officers provided, it would absolutely preclude the possibility of any trade being carried on at all. As regards the stripping, it was easy enough to strip them and to replace the cover in such a way that no harm results to the meat. What was the efficient way to deal with the inspection of foreign meat for disease? The remedy had already begun, because the evil was so apparent that, like all other evils, it brought its own remedy, and must do so in time. With regard to the case of pigs from Holland, which were at one time extensively diseased, the Dutch Government had taken

up the matter, and now had a system of inspection and registration of all animals that are slaughtered, and those were marked in such a way that it could be seen when they came in if they had been inspected or not. That was dealing satisfactorily with the question, and that was the way in which foreign meat must be dealt with, whether coming from the Colonies or elsewhere. There must be some guarantee that it has not only passed Government inspection, but that the inspection has been made with a certain definite object, the object of determining whether at the time of despatch it was fit for food. There were many difficulties and technical points with regard to the inspection of meat, but they should not forget that in dealing with the question of the sale of unsound meat they were dealing with a criminal offence. Therefore the Legislature very properly insists that every possible advantage shall be given to the owner or to the butcher. The whole object of meat inspection was to prevent injury to the public health; the object was not in any shape or way to unnecessarily harass or to persecute a trade. He desired to lay stress on that point because there was a need for it, and the need had been recognised by The Sanitary Institute in forming a course of study and education in order that men might be properly trained, that the mistakes which occur from time to time shall be reduced to a minimum, and that the operations of the authorities shall not be of such a nature as to harass the trade. It is in the co-operation of the trade in meat inspection that the public are protected, and without that co-operation it would be impossible to carry out the duties of meat inspection sufficiently and efficiently.

Mr. James King (Veterinary Inspector, Metropolitan Cattle Market) endorsed the remarks of Dr. Collingridge, and stated that tuberculosis always cropped up at such meetings as this, when the question of meat inspection was being considered, and it was also discussed at the expense of other important diseases or conditions which rendered carcases and meat unfit for human food. No doubt it was the disease most easily recognised by medical officers of health and sanitary inspectors, but he did not think that, so far as beef was concerned, it was such a terribly dangerous disease. With their present knowledge it was about time they began to distinguish, not only, as Dr. Marsden said, between localised and generalised tuberculosis, but also between localised, extensive, and generalised. If there were lesions of the disease from the neck to the hind-quarters, the carcase certainly ought to be condemned. In practice they would often get the fore-quarter diseased, but on searching, either macro- or microscopically, they would fail to find evidence of the disease in any of the glands or tissues of the hind-quarters. That had been proved by the Royal Commission. Why, then, should they deprive a man of the whole carcase when they could protect the public by only condemning a part of it. They adopted the recommendations of the Royal Commission and acted strictly up to them when dealing with home stock, so why should they not apply the same conditions to foreign meat. They also prevented stripped meat coming into this country, but allowed

the Americans to cut up such meat into chunks and send it over in boxes labelled "Inspected Meat." He did not agree with those who objected to stripping. A butcher should be allowed to strip a carcase if he thought fit, as it was his property. The stripping of the carcase was necessary for various reasons, and in his (Mr. King's) opinion it should not be taken as evidence that the animal had been infected with tuberculosis, or of a guilty knowledge on the part of the owner. An inspector might presume that something was wrong, but he ought always to be able to satisfy himself as to the reason for stripping by the condition of the glands. His experience in examination of carcases and meat inspection extended over a period of fourteen years, and he knew that a large number of animals suffered from pleurisy, and that after recovery the pleural surfaces usually remained adherent. When the carcase is being dressed the lungs have to be torn out of the chest, leaving a roughened surface. In such cases the butcher, in order to make the carcase marketable, removes the rest of the pleura, or otherwise strips the whole chest. This, he knew, was objected to by many medical officers of health and sanitary inspectors, but with our present knowledge we can easily find the reason for stripping by examination of the lymphatic glands, the normal condition of which every inspector should be thoroughly acquainted with. If he (Mr. King) found the glands of the carcase apparently healthy, although he may have found the disease localised in some of the organs, it was his custom to pass the carcase and to condemn the whole of the offal. With regard to pigs it might interest them to know that recently, he and his assistant, at the request of the Cattle Markets Committee of the City of London, made careful post-mortem examinations of over 15,000 pigs, the object being to ascertain as near as possible the percentage of those affected with tuberculosis, and the loss sustained by the trade thereby. They found 75, or about one-half per cent., of the number subject to the disease, the value of which, it was ascertained, would amount to about £187. When inspecting carcases the majority of inspectors now acted in accordance with the recommendation of the Royal Commission on Tuberculosis, which allowed them to use their discretion with the carcases of cattle; but, unfortunately, they were not allowed to do so when dealing with the carcases of pigs—the recommendation being that, owing to the greater tendency to generalisation of the disease in pigs, when it is found in any part of the carcase, the whole should be seized. He could not help expressing the opinion that this, with our present knowledge, is a great hardship to the trade. In cattle there was the possibility, in some instances, of diagnosing the disease during life, and very little difficulty in recognising the lesions after slaughter, but in the case of pigs it was entirely different. It was well nigh impossible to diagnose tuberculosis in those animals, and also difficult in the majority of cases to recognise the disease in the carcase, which might appear to a butcher or inspector (who had not seen the internal organs) to be perfectly sound; yet when the glands were incised, the carcase might prove to be extensively diseased. The living membrane of the chest and abdomen were not often affected

as in cattle, and when they were the tubercles were not so numerous, and being much paler, were not so easily noticed. The most common seat of the disease was the glands of the throat. In the course of their investigation, a careful examination was made of all the exposed glands. The glands of the throat and neck were also carefully manipulated, and when found enlarged, the neck was cut into and the cause ascertained. In about 30 per cent. of the pigs condemned the disease was found in those glands only, and no other lesions discovered in other parts of the carcase. It was in such cases as these that the trade complained, and considered the condemnation an injustice, and although it was his duty to seize the carcases, he could not but agree with their views, considering that no compensation was allowed, and knowing the difficulty of recognising the disease during life. He certainly thought that, with the improved knowledge of inspectors, this recommendation regarding the condemnation of tuberculous pigs might now be modified so that they could use their discretion in dealing with pigs as with cattle. This, he understood, was done in Glasgow where, after careful examination, if the glands of the throat only were found affected, the head and affected parts were removed and the remainder of the carcase passed. When a consignment of pigs was found tuberculous it would often be noticed that the pigs came from certain districts and had been fed in the same way, and the disease would often be found in other consignments which came from the same area. He had found the disease in, and had had to condemn, a whole consignment of twelve, and in all cases the glands of the throat had been the primary seat of the disease. He could not help expressing the opinion that this was largely due to careless and ignorant feeding. In London and other large market centres where there was now a proper system of inspection of cattle and carcases, the risk of sending old worn-out tuberculous cows for slaughter was now increased, and there was no doubt that many were now being given to pigs as food. He had himself seen, within ten miles of London, the skeletons of three cows and one horse lying in a pig yard. It seemed to him a great injustice that feeders should be allowed to do this, and that the trade should bear the loss. Dr. Marsden mentioned that he frequently came across pigs with hæmorrhagic patches on the pleura and the peritoneum. This condition, unfortunately, was becoming rather common, and was recognised by veterinary surgeons as the lesions of purpura hæmorrhagica.

Dr. Marsden: Do you condemn them?

Mr. King: Yes! and the trade have never objected to my doing so, as they consider them unmarketable. With regard to drowned or strangulated animals, he agreed with Drs. Collingridge and Marsden that in such cases a considerable time usually lapses before the viscera is removed, decomposition commences in the bowels and stomach, and rapidly extends to the surrounding tissues. This can easily be demonstrated, by cutting a small piece of the kidney fat of such a

carcase, and if the animal has been dead for any length of time, you will be careful about repeating the test. The fat smells horribly, and such carcases, in my opinion, have no right to be passed for human food.

Col. J. Lane Notter, in reply, said there were only one or two points that required notice. Dr. Hime had misread his paper, for he had distinctly laid down that "when tuberculosis is present and well defined and the glands are affected," these conditions should be considered when giving an opinion as to the disposal of carcases and condemning them as unfit for food. Dr. Hime's remarks were therefore based on a misapprehension. The discussion had revealed the fact that there was not a great difference of opinion between authorities dealing with food supplies. Most of the speakers had been answered by others who had contributed to the discussion. With regard to drowned animals, no doubt the rapid decomposition and putrefaction which takes place in these cases was the guiding factor in condemning the meat. He thanked the meeting for its considerate reception of his remarks.

Mr. W. Hunting also acknowledged the compliment. He said that he agreed with Col. Notter that the various speakers had pretty well answered each other. He had little to add to what had been said, but he would like to take the opportunity of pointing out to Dr. Marsden that Dr. Collingridge supplied a practical argument in favour of veterinary inspectors, although he had never specifically mentioned them. Dr. Collingridge had said that it was a remarkable fact that almost the whole of the frozen meat imported into this country showed no disease. Abroad there were quite as many diseases of animals as we have in this country, but all that meat was inspected by veterinary surgeons before it was sent to this country. Dr. Armstrong had referred to offal being sent in boxes; now they were not all *au fait* with the work of foreign meat inspection, but he imagined that those boxes contained many pathological specimens. Dr. Marsden would know that. Dr. Hime thought that the fatty liver of animals might be treated as *pâté de foie gras.*

Dr. Hime: The animal parasites.

Mr. Hunting pointed out that the liver of the goose was purposely fatted; no doubt it was harmless enough. But fatty liver in animals might be accompanied by disease and might be poisonous. He did not fancy "pâté de tapeworm." Everyone of those parasites contains a toxine; experiments recently made showed that the juice of the occupiers of the intestinal canal of animals injected into animals had fatal results. So that these parasites could not be described as altogether harmless.

The Chairman, in summing up the debate, said he was not in a position to enter into a scientific discussion of the subject. He had been engaged in the

meat trade for thirty-five or forty years, and naturally took a great interest in the questions raised. It had properly been suggested that the same law should be applied in one town as in another. He remembered the time at the Central Market when sheep diseased with fluke were condemned, yet on the other side of the road (almost a part of the market) such sheep were allowed to be sold. He agreed with Inspector King that while a fore-quarter might be affected with tuberculosis the hind quarter could be free, and it was reasonable to pass the sound portion. It had not been mentioned that day, but the trade was most anxious that inspection should take place. In the markets the inspectors were often called in by the traders who were not quite sure that they ought to sell. The inspectors would admit that they were continually asked to deal with meat that might not be quite fit to go out to the public. He could assure them the care taken now was extreme. There were buyers who would not have any meat leave the market until the inspector said it could be properly removed. He thought it should go out to the public that they were protected in this manner by inspection, and he hoped that soon there would be a general agreement on practical points so that the men in the trade and the inspectors would know exactly what their duty is under every circumstance.

CONGRESS AT GLASGOW.

INAUGURAL ADDRESS

By The Right Hon. LORD BLYTHSWOOD, LL.D.,

Lord-Lieutenant of Renfrewshire.

President of the Congress.

Delivered July 25th, 1904.

WHEN I was asked whether I would occupy this most exalted position, to which you, gentlemen, have so kindly elected me, I said that I felt I was not equipped to take up the position or to speak in the chair at a Congress such as this, a chair which had been filled by so many eminent men, the names of whom you have heard read just now. Since I have heard those names I can assure you I feel that my words were words of prophecy, and I crave the indulgence of the audience now before me in the work I have to do.

I trust you will forgive me if the address that I give you is a short one. I hope to touch upon some things which may be new, but in view of having experts close around me, experts who are going to speak at their various sections, experts who have spent their lives in this most interesting, and I may say most tremendous, question, this question of public health, you will believe me that I, who am only a tyro in these matters, feel that my training has been quite different. The training that I have given myself in scientific work, whatever that may be, has not led me to consider this great question of hygiene as deeply as no doubt I ought to have done. Still, at the same time, I am a volunteer, and therefore in what I may say this evening I trust you will forgive me if it does not come up to that standard which the eminent men who have gone before me have so worthily upheld.

I must also thank two gentlemen, Mr. Samuel and Mr. Fyfe, for the great assistance which they have given me.

I believe that it is now twenty-one years ago since the Institute last

visited Glasgow; I believe that was in the year 1883, and I feel sure that if there are any members here this evening who came to this city twenty-one years ago, they will see the fruits of their labours in the increased sanitary comforts and arrangements of the city. In Scotland, though no doubt for many years much had been done to improve the sanitary condition of the people, both in the towns and in the country, I may say that sanitation as now recognised came into life in 1885 with the Scotch Registration Act, since which date we have accurate records. But I should just like to touch on the really dreadful condition of things under which the poor people, not only in the towns but in the villages and country districts, lived. A most interesting book by Dr. James Russell was given to me, and I will quote to you just a few lines. For many years Dr. James Russell was Medical Officer of Health in Glasgow, and his report which has come to me is so pertinent and so capable of being understood to-day that I will quote it, although it is most astonishing, and I should have thought that it was almost impossible, that such could have been the condition of Glasgow at the time of which he speaks. But the books and accounts of the country that I have read make it quite evident that there was no exaggeration in what he wrote. He says: "If any man wonders at the prevalence of continued fever among the lower classes in Glasgow"—he is writing of 1818—"let him pick his steps among every species of disgusting filth, through a long alley from four to five feet wide, flanked by houses five floors high, and here and there an open pool of water from which there is no drain, and in which all the nuisance of the neighbourhood are deposited in endless succession, to putrefy and waste away in noxious gases; let him look as he goes along into the cellars which open into these places, and he will probably find internal habitations which no one can distinguish in their exterior, or from the very little bare furniture that is within them, with pigs, cows, and human beings that can scarce be recognised till brought to the light."

I could go on further, but I think that that is a sufficient picture for us to recognise the condition in which Glasgow was in the year 1818. I must point out that it was most difficult to ascertain and to classify the death-rate of the population in the early part of the century. From 1821 to 1832 the city was devastated with epidemic fever and small-pox, and with typhus; from 1832 to 1853 there were three attacks of cholera; in 1843 more than a quarter of the inhabitants suffered from a relapsing fever. It is somewhat difficult to convey to the present generation what all this meant to our forefathers, but an attempt may be made so far as figures will go. In 1837 the population of Glasgow was 253,000 in round numbers,

and the death-rate was 31 per 1,000; in 1847 the population was 320,470 and the death-rate had risen then to 56 per 1,000. In 1893, when the population was 677,880, the death-rate was a little more than 23 per 1,000, shewing a great decrease. In 1903, the last returns that have been available to me, the death-rate has decreased to 18·4 per 1,000, and the year 1903 is chosen as the worst epidemic year of modern times. In this year the total number of deaths from infectious diseases of every description registered was 17,100, so that if every one had been caused by typhus, notwithstanding the increase in the population, we should not have had so much infectious disease or so many cases as there were in epidemic years in the first half of last century.

Well, I think you know, ladies and gentlemen, that that is a wonderful proof of what has been done in Glasgow for the sanitary education and for the sanitary business and work of this great city. I do not wish, as I said before, to go more deeply into these figures, because I know that there are others who will come after me who have made it their life's study, and who have gained fame in doing so, who are far better qualified than I am to deal with these great questions, and with the great work which has been done in the city of Glasgow, but I wish at the present moment just to bring before you a kind of sketch of what has been done. I think I have been able to point out at any rate a condition of affairs in the city that was terrible, at a time when everything that was filthy was pitched into the street, where it was allowed to fester till it was taken casually away to the surrounding fields. Indeed, in the earlier part of the last century that was no peculiarity of Glasgow. I was reading only the other day that in a certain royal burgh in Ayrshire, at the beginning of last century, a noble lord of high degree who lived near could not ride down the High Street until the middens had been taken away. Well, that was the way in which, I suppose, people lived in those days, and it is only wonderful that more deaths from disease did not take place.

It would be useless for me to go more thoroughly into those times. As I said, the Registration Act came in in 1855, and from that time we have been able to classify not only these deaths but also all the other deaths in the country, and to have before us a truthful record and description of what is occurring in the country, and of the incidence of disease.

In 1859 pure water was supplied from Loch Katrine, it having formerly been supplied by two companies, one in the Gorbals—and where do you think the other company's water came from? Why, the Clyde. Well, when water was brought in that manner can we wonder that the statistics of death in Glasgow were so bad? Is it not wonderful that they

were not worse? But there was one thing which the present generation has seen—the Clyde as it stands at the present moment. In those days there was no drainage into it, and immediately after the introduction of pure water in great quantities from Loch Katrine another problem arose, which I will deal with later.

In 1864 the first municipal disinfecting and washing-house was built, and the first sanitary office was opened, and you must remember this, that the first sanitary staff in the city of Glasgow at that time, as I am advised, comprised one man and a clerk, and it was situated in an obscure street. But in 1866 the City Improvement Act was passed, by the process of which the wynds and closes in the city of which I have already spoken were attacked. It was useless to provide wash-houses and to give the poor pure water, unless these parts of the city, with their overcrowding and utter disregard of all sanitary regulations, were cleaned out. The centre of disease would still remain. But all this work took a long time to accomplish, and it is indeed by no means finished or completed yet. This is a problem that will always be with us. What we have done is no doubt very remarkable, for we have, as I have shown, reduced the death-rate by certainly more than one-half.

You must remember that it was only a few years ago the foul disease of cholera put up its head in this city, and it was met by the sanitary officers and by the sanitary regulations, and practically scotched before it could ever get to a head. This is one of the great results which accrue from the scientific attack of disease, and also from sanitary regulations, and the opening out of those places which foster it.

But another problem presented itself as soon as pure water was introduced; a new means of getting rid of the filth had to be devised, drains had to be made, and where do you think they all went? They went into the river Clyde, which thus became an open sewer.

In 1881 the first refuse destructor was erected, but while all these things had been going on do not suppose that the community had not been thinking deeply. The central hospital of Glasgow was then, as it is now, the Royal Infirmary, founded in 1792, with which infirmary the name of Lord Lister will ever be connected. We have the Victoria Infirmary, founded in 1890; the Glasgow Eye Infirmary, founded in 1824; the Royal Hospital for Sick Children in 1882; the Glasgow Samaritan Hospital for Women in 1885, with many minor hospitals, attached to which are many convalescent homes. Then while I am talking of hospitals, I may mention one more thing. I do not think any medical man who is here this evening will deny that one of the greatest adjuncts

they have in combating disease and physical misfortunes (a good many of them) are those devoted women who attend as nurses in the hospitals of Glasgow. There occurs to me the name of Mrs. Higgingbotham, a devoted lady, who in 1875 instituted the district nurses to go among the poor with advice and consolation; and since that time we have had the Queen Victoria nurses, to whom the district nurses were affiliated in 1891. There were sixteen nurses then, and now we have twenty-seven. These women go among the poor, do their beneficent work, and bring sunshine and light into the people's homes, teaching the people how to second the efforts of the sanitary officers, doing the work as only a woman can in times of distress.

I have given you a very short and a most perfunctory description of the condition of Glasgow, and of the ways in which it has been lifted by wise men and by careful administrators into the position which the city now holds, with its vast population, which is continually increasing, of the work that it has to do, and the drainage works that are being carried on. I trust that when these drainage works are completed we shall be able to call upon the neighbouring towns and the populous places around to purify and clean themselves and their waters, so that we may look forward to a period when the salmon will again be seen in the Clyde, as well as in the city arms.

Now, there is one thing I specially wish to draw attention to, and that is the condition of the surrounding parts of Glasgow. It is absolutely necessary that we should consider this other great question, the blotting out of the light which should come to our city. In our northern climes we do not have so much of the cheerful visage of the sun as we might desire to have. All that man has done, at all events up to the present time, is to do as much as he possibly can to blot out the sunshine. Now, I do not think there is anything more vivifying, nor is there a more valuable sanitary officer than the sun himself. I was reading some of the reports that have lately been made on the great smoke nuisance, and of the experiments that have been carried out in Glasgow, and these will give you some idea of what we throw into the atmosphere. The facts will speak for themselves when I tell you that per annum 33·66 cwt. of black mineral stuff and grease is dropped on an acre of ground. But in addition to that, which alone is a very large and astonishing fact, which you have to take into consideration, I think you will agree with me that probably the greatest evil that accrues is, as I have said before, the blotting out of the light.

If I may be permitted for a moment to detain you, I should like to

draw your attention to the new conditions under which we shall have to combat disease. You have laid the foundations, I may say roughly, by bricks and mortar, by the introduction of pure water, by clearing out the dens that were centres of festering disease. Now what you have to do, as we shall certainly always have disease of some kind about us, is to endeavour to alleviate it to the best of our ability. Remember, one great problem which this country has to face arises, for good or for evil, from the policy that has been pursued in the past. Everyone knows that the people are leaving the country districts and are congregating in the great towns. You see in the papers continually the asking of such questions as, "Are we degenerating?" Well, we certainly shall degenerate unless we can carry out perfectly all these sanitary arrangements, and give the people who assemble in large communities that power of recuperation which the natural elements of health demand.

I know that the question of smoke is a very difficult question, but I should just like to bring before you for one moment my experience of it. Living as I do within seven miles of the city of Glasgow, I have been able at any rate to see how it acts upon the vegetable kingdom. When I was a boy, or a young man, on the walls around my garden were any amount of apricots and greengages. The trees are still there, but for many years there has not been such a thing seen on them as fruit. There has been no change so far as the care that has been given to these trees is concerned; but it is the fact, unfortunately, at all events down in the valley of the Clyde, probably from the geographical condition of things, the Highlands of Lanarkshire being colder than the lower lands lying around the sea, unless we have a strong wind from the south, the south-west, or the north-west, the air slides down from the colder parts of Lanarkshire through the valley of the Clyde, bringing all that smoke and smother which has been generated not only in Glasgow but all around it, thus cutting out the vivifying rays of the great master of this world. The consequence is that you find, as far as the finer grades of fruit are concerned, that they are absolutely extinct, despite the greatest care. The fruit houses in which you house them are also not exempt, because, however much heat you choose to give, you cannot give that tonic action which comes from the ultra-violet rays of the sun, which are necessary to vivify the organic system.

I bring this before your notice simply to put before you the great and important effects that must accrue from the present unfortunate condition of affairs. At the present moment I know how difficult the position is; I know how serious will be the imposition of any extra

expense on the great mercantile community with which I am proud to be connected; I know how difficult it is now for them to make, if I may say so, both ends meet. But at the same time I believe that if it were not for a certain amount of what may be called awful conservatism, I think it would be possible to take up some of the inventions which have been made. Some of them, of course, are thoroughly empirical, but there are some which not only reduce the cost by enabling the whole of the carbon to be burnt in the furnace, but also to purify the smoke that comes out, and will not be too expensive for practically dealing with it. At all events, it is a great problem for the people, and I do most earnestly trust that it may be brought before this Congress. I trust that in the future we may really feel that we are doing a great work if we can possibly get rid of that pall which hangs round our cities, and that these people who are coming in from the country to the towns may feel the vivifying influence, as I have said, of the sun, and be enabled by that means to recuperate themselves, and be able to do far more work in their own particular station in life in the great towns than they are able to do while they are going about in a miserable semi-darkness, as we often do in the winter time.

As I said before, the great work that has been done in Glasgow by the efforts and policy of the various authorities under the several Lord Provosts, has been so far successful, and I am sure that those members of The Sanitary Institute Congress who were here twenty-one years ago will agree with me that there is a great change for the better in this important city. When we can see the enormous amount of population, that is continually increasing, I feel almost proud to have worked with those devoted men who have done so much in carrying out the dictates which both patriotism and the desire to help their neighbours have implanted in them.

Now, I will lay this as a kind of foundation—I wish to touch upon one other question which I think is of great importance. I have spoken of Lord Lister and of the wonderful work which he inaugurated at the infirmary in Glasgow. He recognised there the infinitesimal, as it was supposed to be in those days. He recognised the enemies that there were continually about us, and by eliminating them as far as possible he gave to the surgeons a great aid; the last finishing touch that was required after the introduction of anæsthetics, by his epoch-making work which enables the surgeons of to-day to do those very marvellous and extraordinary operations which are now familiar to you on all sides. In speaking of this matter I wish to go a step further. I want you to know and to think of

the position in which all these great inventions have placed us, and of the advantages which have continually been given us. There is no wonder whatever that the sanitary art is one of such slow growth.

You have to combat crass ignorance. I may give you one instance of it. When I was going out to the Crimea with my regiment, the principal medical officer of the Army at that time was asked to send out chloroform for the purpose of reducing the suffering of those who might require surgical aid, and his answer was, "I certainly shall not send it; I look upon the stimulus of the knife as being far better." Now that was said by a humane man; that was the result of crass ignorance, even in a scientific man, who had worked hard in his profession. It illustrates the terrible amount of inertia which every one has to deal with who is at work under new conditions and for a new science, which sanitation really was in those days. What I wish to speak on now are the foundations which I have already laid down, which I think everybody now recognises, which I trust may be taught in the schools and to all young people. I want them all to know and learn and recognise the necessity of sanitation, because a very great deal that is harmful comes as the result of ignorance. People at one time did not believe you when you said a man had a cold and that they might catch it from him. They did not believe that a catarrh was an infectious disease; in the past they did not recognise that certain complaints were infectious, and so they ran about and disseminated illness all over the place.

I do not want to frighten people, but there are certain rules and regulations known to all medical officers of health now which greatly modify the spread of disease, especially among young children, and therefore I think if you possibly can you should get this elementary knowledge brought into all schools and encouraged by the school boards. Sympathetic answers have been given by the Government to representations on the subject. This great question of sanitation should be made a popular subject of instruction among the children, so that later on the knowledge would not strike them all of a sudden with strangeness as a totally new idea. I believe in this way you will help immensely those who are struggling to work for the great end that we are all pressing towards to-day, and so do all we can to eradicate the evils of the Past. Death we must have amongst us; death must always come to man; everyone of us must answer his last call at a certain time. But there is no doubt that we may be able, and that in fact we have been able, by scientific treatment, to reduce the death-rate and to increase the length of life of the population.

There is one thing, of course, which is very melancholy to reflect upon in connection with the great question of degeneration. We certainly have saved a large number of people who I might say had almost better have gone in infancy. These lives have to a certain extent been saved. In the old days only the fittest survived. Science now says very often that the infirm shall live and that the unfit shall be preserved, perhaps to be only a burden to themselves and their friends. No doubt this is our duty, but I do urge this one consideration when people take statistics up and speak of the degeneration of the country, they must remember this fact; that you are saving an immense number of human beings who otherwise would have been destroyed, and these people, I need not say, multiply among themselves and are not likely to bring forth very healthy inhabitants to this country. Therefore we must take all these facts into consideration in judging of large questions of race and population. At the same time I do most sincerely recognise the nature of modern conditions, and believe that it is our duty—our great duty, in fact—to do all we possibly can to make our towns and our populous places as sanitary and as healthy as possible.

Well, I was speaking of the infinitesimal as what we have now got to think of, and I was speaking of the necessity of the sunlight. Just consider what sunlight is. To-day you have that sunlight intercepted; it comes to you through a pall of smoke and fog, and yet that sunlight brings with it a marvellous power that is commonly very little recognised. Sunlight conveys with it a power which is one of the greatest germicides; sunlight conveys with it a power which is transmitted by the infinitesimal. We now must make use of this infinitesimal. It is a great power that has come to stay, and we have at last recognised its value.

It is curious how these things are discovered. I hope to be able in a few moments, without troubling you too long, to prove and explain it to you. Conceive what sunlight, what light is. The wave lengths of light forming deep red are the thirty-two thousandths of an inch long, forty-two thousandths for yellow rays (that is the sodium rays) and about sixty thousandths for the ultra-violet rays. Taking an average of these (the vibrations that enter your eye, which give you those magnificent prospects of which we are so proud, which I hope the members of this Congress will be able to see in the neighbourhood of Glasgow) the marvellous gradations of colour and light, the flashing water, the mists, and the hills around you—these are all conveyed to you by vibrations entering the eye at the rate of one hundred thousand million millions per second. Here indeed you are face to face with the infinitesimal. But what marvellous effects they work. The eye can see a great deal, and I have tried to describe what are

the beauties that it shows us, and how it elevates us and raises us from this earth to see the beauties of nature.

But, my Lord Provost, you who are an expert in photography could get up here and say how these marvellous infinitesimals shake the alloyed salts to pieces and produce on your plates the beautiful pictures of which you have given me one. But it is not only in photography that we find these wonders. We find them in the hospitals, where we try to imitate the sun by the power of the electric arc. You know how the light has conduced to reducing Lupus. It has been tried, perhaps in vain (I do not know, perhaps the time has not yet come), with that fell disease, Cancer. But still, here you have the infinitesimal in nature coming to your aid. It is light, the best light we can give, utterly small in comparison with that light which comes from the ruler of our system, yet it has done great good in these hospitals. We have it in the Royal Infirmary, I think, but at all events it is used in Glasgow.

And then there is another great agent we have, also the infinitesimal, that is electricity itself. Electricity under skilful hands, like those of Dr. Macintyre, has done great good in the Royal Infirmary. Many is the time I have spoken to him upon these subjects, and I am thankful to think that he is hopeful, more than hopeful, of being able to relieve human nature of some of its greatest ills through the agency of electricity. One great reason, I think, why electricity is not more used is that it requires a highly scientific training to be able to use it with the best results. There are so many charlatans going about with their electric belts and all that sort of thing, which have nothing at all to do with electricity, and there is no connection whatever between the two things. But properly used and properly applied I believe that there is to be found in the electric infinitesimal one of the most wonderful things on the face of this earth. We do not know exactly what it is. Even Lord Kelvin, whom I have often described as the High Priest of electricity, a man who knows almost everything, when I asked him the question "What is it?" said "We may know, we do not know yet." But we do know this: that we can use it, and the business that we have to do is to use those things that God gives us, and to use them for the good of our people as well as we can. We may make mistakes; but those are things we cannot help. It is the frailty of our nature and the limitation of our knowledge that lead us to make mistakes. But I think everyone will agree with me that we have had our talents given to us, and it is our business therefore to do our work as well as we possibly can. It may be that our talents are not equal to the work that is given us to do, but at any rate let us try, let us

work, let us not consider because a thing is not understood, because it cannot be calculated accurately, that therefore it is beneath our notice.

Now it is these wonders that are continually coming up before us that make us believe that it is absolutely necessary that we should cast away some of our old ideas. I think you will agree with me that that has been true of surgery, as it is at the present moment true of medicine. But why? Even eminent medical men to whom I have spoken on the subject have told me that we do not know actually why the smallest things do what they do. I can swallow something that does not go down to my lungs and yet it does them good. How does it work? Here again I believe that we are face to face with one of those wonderful wonders of Nature, the nerves and the nervous system, and the nerve centres.

Have you ever considered how much a man has to do with disease; how a man can fight hard with nature, and how often it has been said "Oh, he will recover, he does not intend to die, he is going to fight for it;" yet another man, equally strong, with the same chances, slips away and gives up the fight? That is merely the infinitesimal over again.

Well, let me just ask you one more question. You know these great problems, and I think we ought to go forward and probe them as much as we can, and endeavour to recognise them in all their bearings. There is another thing which has startled us during the last few years—that wonderful thing called radium, a subject in which I have taken a great deal of interest. There again we are face to face with the infinitesimal, yet radium is a great force. I know it has been used in the hospitals. I do not know for myself whether it has done all the work that it was intended to do, but, dissolved as Nature does it, I think that it has wonderful curative effects. There are many things upon which doctors agree, but all who have spoken to me on the subject have told me one curious thing, that salts in ordinary water, whatever salts you may put in, never penetrate through the skin. Naturally, the question I immediately ask them is, "Then, what is the good of my going to Bath to bathe in the waters there? They certainly do me good." Their answer is that they do not know. Now there is no doubt that in the Bath waters radium exists—I have seen it myself. If we have these wonderful emanations coming through the waters there, you may have the answer to what was inexplicable before. In Buxton you have the same thing, although not so strongly as at Bath. Here then again we are face to face with the wonderful infinitesimal, and we must make use of these things. We are forced now to believe in things that we can only at best calculate, we cannot yet understand them, and we may never see them to perfection; but we can

if we use them rightly, I am sure, alleviate many of the pangs of human nature.

There is one other great thing that the work of your Institute is doing now, a work to which I am sure you are all willing to put your hand to the best of your ability. By increasing the sanitary comforts of this country, by improving the sanitary conditions of the towns to which the people are flocking, by improving the condition of the people's lives, you are giving a tone to our population, and are so doing a great and material work. We are all proud of the work which our forefathers did, and we intend to hold it. But we shall not be able to do so unless we can make and keep the population of these islands at the same high standard they had before, which I trust they may ever have, and certainly one of the great agents for doing that and maintaining that high standard will be Sanitation.

CONGRESS AT GLASGOW.

SECTION I.
SANITARY SCIENCE AND PREVENTIVE MEDICINE.

ADDRESS

By Prof. J. GLAISTER, M.D., D.P.H., F.F.P.S.G., F.C.S., F.R.S.E.

President of the Section.
(Fellow.)

SMALLPOX INFECTION FROM HOSPITALS:

A Critical Study of the Doctrine of Aerial Convection of Smallpox, based upon the Histories of Previous Epidemics.

OF the many problems in Preventive Medicine which are occupying the attention of sanitarians at the present time, probably none is of so great and urgent importance as the prevention of smallpox.

Although for over a century a preventive remedy has been discovered whereby its fell ravages might be stayed, and although the practice of vaccination has been the statute law of this country for about half that period, the sanitarian is being confronted in different parts of this country at the present day by more or less widespread epidemics of the disease, which cause great discomfort at least to those who are stricken, some loss of life in those who are unvaccinated, much anxiety to the communities in which the outbreaks occur, and considerable outlays of public money in effecting their repression.

A necessary part of the machinery to deal with such outbreaks is the smallpox hospital with all the administrative machinery which it involves, necessary because vaccination practised in infancy does not afford a life-long immunity against the disease, although calculated to permit only of modified forms of attack when infantile vaccination has been efficiently performed, but chiefly, because there exist in our populations those upon whom the operation of vaccination has never been performed, and who,

consequently, after exposure to infection are seized with the graver forms of the disease, and thus become a menace generally to the public health.

The net result of the operations of the present vaccination law in this country up till the present time is that the great bulk of the community has been protected against the more generally fatal consequences characteristic of those outbreaks which occurred before vaccination became a compulsory measure. Smallpox has now lost many of its terrors for communities because of this, and because of the knowledge, based upon the experiences of every country in which vaccination has prevailed, that an attack after primary vaccination is but rarely attended by symptoms which menace life.

On account, however, of the relatively temporary immunity which primary vaccination affords, the need for re-vaccination between the tenth and twelfth year of life has forced itself upon the minds of those engaged in the public health service. But re-vaccination is not compulsory at present in this country; and on account of the less prevalent practice of it, even in the face of epidemics, there is now in our midst a large population whose original immunity against the disease has become so lessened by the lapse of time, that epidemics of the milder forms of the disease may be expected to happen from time to time in our larger populations, as recent experience has shown in different cities of this country. Indeed, the history of the last twenty years, and more particularly of the last ten years, abundantly proves the truth of this. Moreover, this state of things has led, and will in the future lead, to a somewhat unexpected difficulty in the repression of outbreaks, viz., the difficulty, nay, inability, in not a few instances, in discovering the sources of infection due to ambulant cases of the disease which are so mild that they give rise merely to a few days' indisposition, and very often to the neglect of calling for medical attendance. Such has been amply demonstrated in the epidemic of the disease in Glasgow, and in other places.

So long, therefore, as this condition of matters continues, the smallpox hospital must remain an essential part of our armamentarium against the spread of the disease.

Did re-vaccination, however, become the common practice in this country as, for example, it is in Germany, the hospital devoted to the sole uses of smallpox treatment might be allowed to fall into desuetude, and cases of that disease, when they did arise from importation, as they are bound to arise owing to the dissimilarity in efficiency of the practice of vaccination in different countries from which emigrants come, and because of the movements of persons from nation to nation through commercial inter-

course, could be treated in our general infectious hospitals, or, indeed, in our general hospitals, because of the then protected position of our people.

This is exemplified in the smallpox history of Germany, as shown in Dr. Bruce Low's Report to the Local Government Board of England "On the arrangements made in Germany for the isolation of smallpox cases."

When Dr. Low began his investigations in Germany, he first proceeded to Berlin. He himself after inquiry could hear of no smallpox in that country. The Central Health Office in Berlin knew of none. Accordingly, it was arranged that he should visit chief representative cities of the four principal States of the German Empire. He visited ten cities in all these different States, the total population of which was nearly five millions of persons. He could not find a single case of smallpox in any of them. During the years 1895–1901 inclusive, there had been only 70 cases in Berlin; in Cologne, 1 case during ten years; in Wiesbaden, there were 12 cases eleven years ago, but there had been none since that time; in Mainz, there had been no case during eleven years; in Munich, there had been 7 cases in eight years; in Nuremberg, none for about eleven years; in Dresden, there had been no deaths from the disease during the previous ten years; in Leipzig, there had been 8 cases in eight years; and in Stuttgart, there had been no case during six years. He was informed that the cases which had been present in Germany during these years had been imported from neighbouring States, as Russia, Austria, Italy, or other country.

He contrasts the position of Germany with that of our own country in respect of the incidence and mortality of smallpox. During the twelve years, 1891–1902, Germany with a population of 56 millions had only 607 deaths, while Great Britain with a population of 32 millions had had, in the same years, 6,761 deaths.

With regard to hospital provision for the isolation and treatment of smallpox, he found the practice of these countries to differ materially. Compared with the provision in this country, that of Germany may be said to be non-existent. In Berlin, for example, with a population of two millions, the entire provision for smallpox treatment is twelve beds made up of a pavilion containing two wards, not in a special hospital, but forming part of the Royal Charitie Hospital of that city, which is one of its largest general hospitals, consisting of 1,500 beds. The smallpox pavilion is separated from the nearest scarlet fever ward by about 24 feet, and is distant only 150 feet from a street which bounds the hospital, and from an open fence which separates the street from the hospital grounds. The cooking for the smallpox patients, when there are any, is

done in the general hospital kitchen, and the soiled linen is washed in the general laundry. It is compulsory, however, that the staff in attendance upon the smallpox patients must be re-vaccinated. Isolation, therefore, as we understand and practise it in this country, and as exemplified in the regulations for erection of hospitals of the English Local Government Board, does not prevail in Germany. The only hospital in Germany which Dr. Low found was devoted to smallpox was in Mainz. It is situated in the grounds of a florist and nursery gardener, in which also are the gardener's house, greenhouses, etc. It had been erected in 1892 for cholera, but since that time had been left for smallpox. So far as Dr. Low could find out, there never had been a case of smallpox within it.

The reason why there seems in Germany to be such a contempt of smallpox is to be found in the protected condition of the entire population of the country by vaccination and re-vaccination, both of which are by law compulsory; and it is for the same reason that when cases of smallpox do arise in populous centres, they are treated in the wards of a general hospital, and their existence utilised for the purpose of the clinical instruction of medical students.

It is only necessary to compare and contrast the enormous capital expenditure in smallpox hospital erection and the annual cost of upkeep in this country, with the absence of both in Germany, to demonstrate the great advantages which would be conferred upon this country by a compulsory system of re-vaccination, leaving out of the reckoning the enormous private loss which is involved in the sickness of patients from the disease. So long, however, as a general compulsory system of re-vaccination does not exist in this country as a legislative enactment, so long will it be necessary for the State and local authorities to maintain efficient hospital equipments to cope with recurring outbreaks of the disease; of the milder forms in the vaccinated, and of the graver forms in the unvaccinated and in the inefficiently vaccinated.

This brings me to the question with which I propose more particularly to deal in this address, viz.: The Influence, if any, of Hospitals devoted to the Treatment of Smallpox upon the communities in which they are placed.

Involved in this large question are several propositions which must be subjected to careful and critical scrutiny before definite opinions may be expressed regarding them. It appears to me that the general proposition respecting smallpox hospital influence must be faced under two main heads:

I. The effect, if any, of a smallpox hospital upon neighbouring popu-

lations by reason of mere situation and propinquity, as exhibited in ordinary sources of infection, direct or mediate; and

II. The effect, if any, of a hospital owing to situation and propinquity, as exhibited in the production of infection of neighbouring population by other than ordinary sources of infection.

Let me first ask your attention briefly to the former of these propositions.

In considering the effect of a smallpox hospital upon contiguous population, prominence must be given to the fact that the hospital is a place which contains persons suffering from acute attacks of the disease, as well, usually, as convalescents. It differs only from a place containing a single case of smallpox relative to infective capability, in that numbers of cases are collected together, the combined effect of which is likely to increase the capability to infect. Consequently persons attached to the administration of a hospital must be subject to such rules as prevail for smallpox contacts with regard to their potentialities for spreading infection. Such rules have been formulated, and are generally practised in such hospitals for those of their staffs who have occasion to leave hospital and mix with outside persons, among whom are likely to be susceptible people.

But dealing with the allegation that smallpox hospitals are the cause of spread of the disease to propinquous population, any inquiry as to the truth of the allegation must be founded on lines such as are likely to reveal whether or not mal-administration, or other conditions, have existed; in other words, whether facilities from the hospital have been afforded for the spread of the disease by the ordinary direct or mediate methods. Under the second proposition, prominence must be given in the inquiry to any influence which smallpox contagium may possess, because of some difference or differences which belong to it, as compared with the contagia of other infective diseases; that is, to properties peculiar to the contagium of smallpox, and to any special properties it may possess under any given set of circumstances relative to its convection in other than the usual methods.

It seems to me that in any inquiry regarding the influence which a smallpox hospital is believed to have upon contiguous population, it is absolutely necessary to discriminate between these propositions with which I have started, else we shall be liable to arrive at false conclusions.

In an inquiry, therefore, regarding spread of smallpox from a hospital, the line of inquiry must first be regarding facilities from the hospital for the spread of the disease outside by the usual channels, and by direct and

mediate methods, and the inquiry must be exhaustive in this direction before the question of possible spread by unusual means should be allowed to emerge. In the whole inquiry, too, if we are to proceed on safe lines, and hope to arrive at a true conclusion, the laws of evidence must be strictly applied. It may, indeed, happen that one observer of an epidemic and its relations to a hospital may fail to discriminate between the value of evidence pointing on the one hand to direct and mediate infection from the hospital, and of the evidence which is believed by him to be exhibited in a special mode of convection of the infection.

Infection in smallpox is either direct or mediate, or both. All are agreed upon this fact. And that such modes of infection may prevail from a smallpox hospital to some variable extent, no one will be prepared to deny. But it has been stated that infection may be conveyed to a surrounding population by aerial dissemination, diffusion, or convection; and those who believe that this has been proved for variable distances from a hospital, signify that this mode of transmission differentiates small pox from other infectious diseases.

In any epidemic of smallpox in a population, whether near to a hospital or not, the spread of the disease is due to infection either direct or mediate from an antecedent case, and in an average epidemic both of these modes operate in greater or lesser degree. The advocates of the theory of aerial transmission go further than this, however, in declaring that, added to these modes of infection which they frankly admit, there must be linked the possibility, nay, the likelihood, of transmission by the atmosphere.

Apart, for the moment, from the influence of a hospital, it must be acknowledged at the very outset that, whatever may be the characteristic which smallpox contagium possesses, it is capable of being transmitted aerially from one infected person, or thing, to susceptible persons for variably *short* distances. This is well proved. But when we come to consider the amount of distance through which smallpox effectively carries, or may aerially be effectively carried, we arrive at once at differences of opinion of an acute kind, because of the difficulty of leaving out of count the possible opportunities of infection by the more generally accepted means during the currency of any epidemic.

It would be impossible for me in the time at my disposal to deal with this subject as completely as it should be dealt with, owing to the enormous mass of material which has had to be reviewed dealing with those epidemics in which aerial convection of the disease was believed to prevail. I propose, however, to deal with the conclusions at which I have arrived regarding

this doctrine from a critical perusal of all the evidence of many epidemics and of other literature, leaving it to another place and occasion to put the grounds of my conclusions before the profession.

My conclusions respecting the first proposition, that smallpox hospitals, because of their vicinage to population, are a source of disease among persons in such populations, are as follow :

It appears to me well established that the mere existence of a smallpox hospital in relatively close proximity to a populous neighbourhood is a source of danger to the population, and tends to the spread of smallpox therefrom, and that infection may be, and has been, conveyed to outsiders, both directly and mediately. The reasons for this conclusion are these :— In the first place, and perhaps mainly, the hospital is the centre during an epidemic of a large amount of traffic. Ambulance traffic to and from, visits of friends and relatives of those afflicted to inquiry-room, and to wards, under certain general precautions, to see friends or relatives whose lives are in danger, "leakages" of various kinds from the hospital through the agency of the staff, workmen, tradesmen, cleaners, and others, under circumstances of imperfect supervision or from infringement of hospital regulations.

If we examine the records of the epidemics of Fulham, Sheffield, Warrington, Leicester, Orsett, and other places (epidemics, moreover, in which the aerial theory of convection has been invoked to account for the spread of the disease in the surrounding population), abundant evidence of imperfect administration, of structural deficiencies, or of other factors will be found.

In view, therefore, of the fallibility of all human rules and of the power of observing them, even the best hospital regulations break down more or less under stress of epidemic circumstances, and more especially when all the resources of the hospital are being taxed to their greatest, and when they are apt to be overcrowded.

So far most persons will agree ; but when we critically examine the second proposition, viz., that smallpox hospitals near to populations exert a special capability to spread infection by the atmosphere, we are met at once by special difficulties, because there must first be eliminated the possibilities of spread by ordinary means. This cannot be said to be a trifling difficulty ; but it has to be overcome before aerial convection may be considered at all. All those who have had practical acquaintance with the difficulties, in certain classes of population particularly, of obtaining accurate information for the three days which are indicated by the dates of their sickening as the dates of their having contracted infection, realise

how impossible this often is. Here the personal equation of the observer or inquirer comes into play. The memories of such persons are often at fault, and even if their memories are of the best, because of the possibilities of mediate infection, they may not be able to indicate any possible source of infection. Moreover, among the poorer classes of the population, information may be wilfully withheld for interested reasons, as it has been proved to be; ignorance regarding attack by the disease, because of its trifling symptoms, may exist; and there are the consequent chances of accidental relationships with unrecognised cases of the disease. All these are facts which are discoverable in epidemics.

The doctrine of the aerial transmission of smallpox is by no means a doctrine of the last thirty years. Dr. John C. McVail, in his paper "On the Aerial Convection of Smallpox from Hospitals" gives at length (Trans. Epidemiolog. Soc., Vol. XIII., pp. 38—42), an account of the inquiry initiated by Dr. Haygarth, of Chester, in the last quarter of the eighteenth century with respect to the transmissibility of smallpox by miasms, and of the controversy which arose therefrom, owing to answers to his queries by one of his correspondents, Professor Waterhouse of Cambridge, New England. To that I do not at present propose to allude, further than to say that Haygarth started his inquiry with the object to ascertain the views of his correspondents regarding what he himself held, that small-pox could not be aerially spread from room to room in the same house, and that, contrary to the doctrine of Paulet, if it were spread outside of the room it was by the agency of miasms, and not by actual contact. Haygarth believed that the something transmitted from smallpox was not particulate, but something dissolved in the air of a gaseous character. Waterhouse, however, had come to the belief in the value of isolation of smallpox cases, and practised it. Further, he believed in the possibility of aerial transmission. He declared "we have the clearest proof of the smallpox being communicated to the distance of several hundred roods, viz., from the hospital at West Boston to several families in the neighbourhood." The result of the correspondence between them was that, apparently, Haygarth converted Waterhouse to his way of thinking.

From time to time during the last century, there would seem to have been recrudescences of the aerial doctrine. In Thorne's Report on "The Use and Influence of Hospitals for Infectious Diseases" (Tenth Annual Report of the Local Government Board, 1880–81, supplement, p. 40), there are narrated several instances in which it was believed that aerial transmission existed, but in these instances ordinary sources of infection

could not be excluded. In addition to these are others, at Nottingham, for example, and at Leeds, in which no evidence of aerial transmission could be obtained, although in one of the cases it would have been welcomed as a reason for closing the smallpox hospital. In the Leeds case the smallpox hospital, which contained 118 patients, was situated from 36 to 200 feet from neighbouring dwelling-houses; and in the Nottingham case, smallpox patients were taken into a new wing which was immediately continuous with the workhouse buildings, and was bounded on one side by a narrow street. Although the windows of the smallpox wards were only 44 feet away from the opposite dwelling-houses, no evidence, after inquiry, could be obtained that smallpox was spread to the neighbouring houses.

A different complexion, however, was given to the aerial transmission theory by the Report of Mr. W. H. Power "On the Influence of the Fulham Smallpox Hospital on the Neighbourhood Surrounding It." (*Vide* op. cit.)

This hospital was exceptionally well-situated to test the possibility of aerial convection of smallpox, being well isolated from the surrounding neighbourhood by open spaces, such as athletic grounds, a cemetery, and unbuilt-on land. It was the point of convergence of two main lines of traffic by ambulances. The number of houses within 500 feet of the hospital was very small; outside the 500 feet limit, and up to the $\frac{1}{4}$-mile radius from the hospital centre, houses numbered only a few hundreds. Beyond that limit, houses encompassed the hospital on every side. To the south and west of the hospital in the direction of the Thames, Putney, and Hammersmith, the house-belt was in some parts comparatively narrow, but in other directions there was a continuous and dense population.

In December, 1880, an epidemic of smallpox broke out in the East end of London, and Fulham Hospital was called upon to house some of the cases. At this time the parishes of Chelsea, Kensington, and Fulham, which surround the hospital, were free from the disease. The central districts of London were as yet little affected by smallpox, the West end districts were relatively free. In the natural sequence of events, assuming a spread of the disease to take place, the West end districts would become affected only after the disease had invaded the central districts. The parishes of Chelsea, Kensington, and Fulham were not expected to show epidemic influence, for the reason that only a few months had elapsed since an epidemic in them had burned itself out (covering a period of four years) during which time nearly 2,000 persons had been attacked, and a much larger number had been protected by vaccination.

Fulham Hospital was used at first to house convalescent smallpox cases, but later fifty-five acute cases were also taken in. Of these fifty-five, only five came from Chelsea, Kensington, and Fulham; fifteen from Central London districts, and the rest from Islington and elsewhere. Power, in order to discover any relationship between the hospital and smallpox cases within these three parishes, drew an area around the hospital which contained several thousands of population, and which, at the same time, was sufficiently small to enable close study of the course of events. This special area was an area included within a circle of a mile radius from the centre of the hospital. The time-periods were fortnightly. Power was assisted in his inquiry by the local authorities of the different parishes. He believed at the end of his inquiry that few cases had escaped his observation.

It was on 13th December that the hospital was re-opened for these East end cases. It was not until three weeks had elapsed after the opening of the hospital that smallpox cases began to develop. Up till the 17th January, fifty-five cases, as has been said, had been admitted. By the 22nd of that month, the attacks from the three parishes numbered eleven, of which seven lived in the special area, six lived at least half a mile from the hospital, and five of them in houses widely separated from one another. In four of these direct or mediate sources of infection were likely; of the other three, the source of infection was not traced completely. One of these three had been regarded as a case of chicken-pox, and did not come under notice until later, when unmistakable smallpox broke out in the house in which one of these cases acted as servant. Respecting the two others, it was stated that they had not been out of the district for some weeks before, and they denied any knowledge of communications of any sort with the hospital. So far, therefore, there was no evidence to impeach the hospital. By this time, forty-eight cases of acute and twenty-two cases of convalescent smallpox had been admitted to the hospital.

During the next fortnight, however, a great outburst took place within the three parishes. The number of fresh cases rose at a bound to sixty-two. Of this number, forty-seven were in the special area; and of the rest, eleven lived within a further half-mile of the hospital. Fifty-six households were freshly invaded, of which forty-one were within the special area, and the other eleven within the further half-mile. Of these sixty-two cases, four only began to be ill before 26th January, while on that and four succeeding days forty-two persons were attacked. Of these forty-two, no fewer than thirty-two were of persons living within the special area, and other eight within one and a half miles of the hospital.

These thirty-two persons, then, must have contracted infection about the same time, that is within the five days Jan. 26–30. Power thereupon instituted a minute investigation of the day-to-day doings of these individuals, with the following results:—In nine, evidence was got, or reasonable suspicion could be entertained, of direct or indirect infection from previous smallpox. One was from a house in which a case of the disease had already been removed to hospital; a second had been at a house where there was chicken-pox; a third was the blind-maker to Fulham hospital; a fourth lived in a street in which smallpox had been a fortnight previously; a fifth worked near the hospital, and had been drinking beer with ambulance men in a public-house; and the four others had had business in quarters of London in which the disease was prevalent. Of the remaining twenty-three, scarcely a hint was obtainable which could be said to account for their attack; all denied any knowledge of having been exposed to infection of smallpox, none could remember any kind of communication with the hospital or with persons connected therewith. Even in view of these facts, Power could not say that there had been revealed any evidence that the hospital had been any factor in their production: "indeed, it was seen to be quite possible that the outburst in question had been the result of a congeries of unrecognised accidents in no way immediately connected with the hospital, but which were peculiar to the particular moment. Unless, therefore, it could be shown that in other years during which the hospital was in use for smallpox there had been exceptional incidence of the disease on the special area around it, occasion for believing the hospital to have been concerned in the outbreak of 1881 did not of necessity arise."

Accordingly, resort was had to the study of the facts of former years so far as they could be ascertained generally. Power admits with reference to this subsequent inquiry that "investigation into the behaviour of smallpox in the three parishes during former years could not be made so complete as the inquiry into the facts of the current epidemic." Records, however, were available of the cases treated in hospital, but there was no complete record of those treated in private houses.

As the result, generally, of this later inquiry, Power found as follows: Fulham Hospital was opened on 10th March, 1877. In November, 1876, smallpox became widely diffused in London, and it began to spread in the three parishes of Chelsea, Kensington, and Fulham. In December, indeed, between 30 and 40 cases therefrom had to be taken into a hospital. By March, 1877, although smallpox continued to prevail to the highest point, it had also increased in the three parishes, and continued to prevail

therein until July, when it began to decline. In the 21 months from March, 1876, till the end of December, 1877, 476 houses in the three parishes were invaded, of which 148 were in the special area, and 328 in other parts of the parishes outside the special area. "In these figures," says Power, "there is no suggestion whatever of exceptional incidence of smallpox on the special area which contains Fulham Hospital." Out of these 21 months, in 9 only could Fulham Hospital exercise any effect upon the surrounding neighbourhood: consequently, the inquiry narrowed itself down to these 9 months. Based on the attack-rate per 100 houses, it was found, taking the parishes as a whole, that the attack-rate before the hospital was opened, was ·41, and after, ·94; in the special area, before, ·15, after, 1·10; and in the remaining parts of the parishes, before, ·54, and after, ·86. Power concluded, therefore, that the increase in attack-rate within the special area after the hospital was in use, amounted to from seven to eight times more than it was prior to that event, and in the rest of the parishes it was nearly doubled.

During the epidemic period January–August, 1878, the hospital being in active use for the treatment of smallpox in London in January of that year, cases of smallpox began in March to appear in the three parishes, which since the previous autumn had been free from the disease, and they began to contribute in excess of other parishes. In the fortnight ending 20th April, no fewer than 81 cases were sent from them into the hospital. From early January till the end of August, 368 houses were invaded in the three parishes, of which 211 were in the special area, and 157 in other parts of the parishes. Attack-rates per 100 houses during this period were respectively 1·80 in the special area and ·67 in the rest of the parishes.

Generally speaking, the same course of events was observed during the epidemic periods of 1878–9, and of 1880.

Following the same line of inquiry respecting the epidemic on which he made his report to the Local Government Board, with the advantages of personal investigation of the known cases, and after delimitation of the special area into (1) a central ring or circle within a quarter of a mile; (2) a ring a quarter to half mile; (3) a half to three quarter mile ring; and (4) a three-quarter to a mile ring; the relative gradational incidence of cases as the hospital was approached was the same as in former periods. He notes that in certain periods, particularly that ending February 19th, 1881, although there was a diminution in the absolute amount of smallpox, the ratios of percentage invasions remained the same. "If," he argues, "the spread of smallpox had been from one infected

house to another, or if it had been by distribution from the hospital by way of ambulances, visitors, and the like, this minor incidence was hardly to be expected." From maps, showing the distribution of cases, the ambulance routes, the railway station at which friends and relatives of patients in hospital arrived within the hospital area, he points out that the distribution of cases around the hospital was notably uniform in direction, and did not affect specially lines of human movements. He came to the conclusion that this unexpected fact was in harmony with the other fact, that out of the thirty-two persons attacked in the outburst at the end of January, twenty-three of them could not be shown to have had associations with the hospital, its staff, or with antecedent cases of smallpox, so far as could be ascertained. Of the twenty-three cases, he gives the following illustrations of the kind of persons attacked: (1) that of an unvaccinated infant who for a month before had not been out of the house; (2) that of an invalid lady who had not been out of her house since the previous September, and who was attacked on 30th January. Twelve of these twenty-three cases were investigated separately by Dr. Dudfield, the Medical Officer of Kensington, in whose district they occurred, and he likewise failed to find any trace of antecedent source of infection.

Power's final conclusions on the whole matter regarding Fulham Hospital are these: "Since the establishment of Fulham Hospital, the several sections into which the special area has been divided have suffered an incidence of smallpox varying with the closeness of their relation to the hospital. The small circle containing the hospital, and having few dwellings a quarter of a mile distant therefrom, has suffered in such dwellings as it contains much in excess of the second ring, and the second in excess of the third. So that for the whole period there is something like a doubling of the smallpox incidence, section by section, progressively from the circumference of the special area towards the centre, where the small circular section containing the hospital is seen to have suffered an incidence approaching to eight times that of the third or outer ring. And this is not all; for, given a particular epidemic with a certain degree of smallpox incidence on the several sub-areas, it will be found that another epidemic with the double or half of this degree of incidence on the whole area results in an almost doubling or halving of the several gradations of incidence upon the several parts of the area. Finally, it is strikingly apparent that the degree of smallpox incidence on the whole special area with the related gradations of incidence on the several sub-areas has again and again, since the initiatory epidemic of 1877, been singularly exactly proportioned to the operations of the hospital as measured by the admissions thereto of acute smallpox cases."

Power fully recognised respecting this hospital that there were sources of infection from the hospital which could not be blinked. For example, friends were admitted to see dying patients, although they were made to wear an over-all dress. Very particular regulations had been laid down for observance by the hospital staff. Tradesmen were liable to come in contact with sources of infection in the persons of members of the staff whom they chanced to meet about the steward's office. Of these, however, he says none are known to have conveyed infection to their homes without themselves suffering from the disease. At the same time, two non-revaccinated tradesmen took smallpox during the currency of this epidemic: one a dustman, who himself was taken ill 13 days after his visit to the hospital, and who infected two of his sons and a lodger in his house; the other being the hospital blind-maker. There were complaints of ambulance men drinking in public-houses. It will be recollected that the source of infection in one case was attributed to this cause. Power, recognising these possibilities, nevertheless concludes that they could not explain the facts. Neither could ambulance routes do so, for 20 to 30 houses away from the lines of route were attacked in different directions.

He was of opinion that the hospital influence might have been accelerated by the atmospheric conditions prevailing at the time. During the January outburst "a period of severe frost, characterised by still, sometimes foggy, weather, with occasional light airs from nearly all points of the compass" prevailed, and it was noted that ozone was present in the atmosphere just before, was absent during, and reappeared at the end of the period in which sufferers became infected. Another contributory factor in atmospheric dissemination which he suspected was the concentration of smallpox in a hospital, especially under certain ill-defined conditions as to potency and intensity of contagium.

In the later epidemic period of 1884–85 also, there was repeated the same story as to incidence as that of the former outbreaks.

In Dr. G. S. Buchanan's report to the Local Government Board on Epidemic Smallpox in the Orsett Union in 1901–02, p. 26, that writer cites as examples of smallpox epidemics in which graduated intensity of incidence from hospital influence has been observed, in addition to Fulham, with which I have just dealt, the epidemics of Sheffield in 1887–8, of Oldham in 1893, of Warrington in 1892–3, of Bradford in 1893, and last of all that of Glasgow in 1900–1.

I propose only to give some facts and my conclusions respecting these from a full and critical investigation of their details.

Sheffield Epidemic of 1887–8.—Barry's Report of this epidemic is the main source of my facts. It deals with the material collected from the house-to-house visitation of some 60,000 houses, and takes minute account of over 6,000 cases of smallpox, and of about 600 deaths. Sheffield, with its population of 300,000 persons, was very ill-prepared for this epidemic. It had a borough hospital for infectious diseases with sixty-four beds, but this was considerably overcrowded during most of the worst period of the epidemic. Close by it were many inhabited houses of the poorer types, and extending for over 4,000 feet from it to the north-east, east, and south-east was a dense population. In the correspondingly western direction houses were fewer and of better class. During the currency of the epidemic, it was found that the houses within circles of 1,000 and 4,000 feet from the hospital became attacked almost simultaneously and suddenly to a degree amounting to eightyfold and a dozenfold respectively, while the incidence of the disease upon those living within a series of zones around the institution varied precisely as the distance from the hospital varied. At the time of outbreak of the epidemic, the special area round the hospital was absolutely free from smallpox. During the first two months of a small prevalence, the incidence of the disease in the borough was almost confined to those parts of it outside the special area, the hospital during this time being hardly or not at all in use. When, however, it began to be filled with patients, a smart outbreak took place in the immediate vicinity of the hospital, while half-a-dozen cases only occurred elsewhere throughout the whole borough. Indeed, during one complete fortnight, whilst cases were multiplying within the special area, only one case was attacked in the remainder of the town. Thereafter, fortnight by fortnight, it steadily developed within the special area, and thence spread to the outer zones, until eventually a large epidemic raged over the whole borough.

There cannot be the least doubt that in this epidemic the hospital did more harm than good to the town of Sheffield. There were some of the gravest faults of administration exhibited, and facilities for the spread of the disease within the special area in this way from the hospital were very great. There seems to me to be no evidence which would support the view that in this epidemic aerial dissemination of the disease was a factor. There is, on the other hand, in connection with some of the other institutions in that town which were used for smallpox, good reasons for distinctly negativing the view. These may be named. The Sheffield Guardians threw open certain of their buildings for smallpox within the workhouse grounds. The buildings for smallpox were only from 130 to

180 feet distant from the general infirmary of the union. Sixteen persons, inmates of the workhouse, took smallpox, but Barry says of these "that defects of workhouse administration have in all probability been mainly responsible for the smallpox which occurred in that institution, and that belief in direct atmospheric conveyance of infection from the hospital to the workhouse is not necessary in explanation of the smallpox there."

The same conditions, if not more accentuated with reference to related positions of smallpox buildings to general workhouse buildings, obtained in connection with the Ecclesall Bierlow Union. Twenty-six persons in the buildings neighbouring the smallpox buildings were attacked. Regarding all these cases, Barry concluded that there was a strong probability that their infection was derived from communications of one sort or another with the smallpox hospital in the grounds.

Here, then, are two institutional populations living in very close proximity to smallpox wards, which were overcrowded during a considerable period, and direct or mediate infection is able to account for all the cases attacked. Surely if aerial dissemination prevails as a necessary sequent of concentration of smallpox cases, it ought to have exhibited its influence in these cases.

It appears to me, therefore, that aerial dissemination did not take place from the borough hospital; at least, it is not proved. And it is proved that it did not exist in the case of the Sheffield Union and Ecclesall Bierlow Union.

Oldham Epidemic, 1888.—Careful consideration of the facts relating to this epidemic confirm the conclusion at which Dr. Niven arrived on investigations of the facts upon the spot. In this epidemic, the first case attacked in the neighbourhood of the Westhulme Hospital was a lady who had had a mild attack which was not at first recognised, indeed, not till after she had infected her infant and husband. There were found during this epidemic unrecognised cases which were going about for some time after attack.

A common lodging-house was infected, and several cases were derived therefrom. The very first case in Oldham was in the person of a tramp. Dr. Niven found, during his inquiry on the individual cases, that all the known cases fell into fairly well-defined groups, that in some of these groups, undoubtedly forming foci of infection, were cases which were either entirely overlooked or were overlooked for varyingly long periods. He prepared certain tables, one showing the groups of cases, and another

indicating the proportion of infected houses to total houses in different areas round the hospital and other points as centres. Niven's conclusion on the whole subject, in the light of his facts, was that "there is not sufficient evidence to charge the hospital with causing the cases in its neighbourhood. . . . . The cases admitted into, discharged from, and which died daily in the hospital from January 1st to September 30th, 1888, only serve to show that so far as mere numbers are concerned, they were enough, on Power's scale, to spread the disease aerially, and that when most cases were in the hospital, the disease was not conveyed aerially to Burnley Lane, in spite of winds and other conditions favouring." He arrived at a similar conclusion respecting the outbreak of 1892–3.

Warrington Epidemic in 1892–3.—Reported upon by Dr. Thomas D. Savill. (Vaccination Commission. Fifth Report, Appendix V.)

From May, 1892, till May, 1893, the number of cases of smallpox was 667, the epidemic being at its worst between September 10th and December 3rd, 1892. The Notification Act was adopted very early in Warrington, the Warrington Act coming into force in July, 1879. The population numbered, on estimate at Midsummer, 1892, 54,000, and the number of inhabited houses, 10,000. The extent of the epidemic was due in the opinion of Savill to the following reasons, viz.: (1) Non-recognition of the earlier cases; (2) Deficient hospital accommodation; and (3) Deficiency of re-vaccination.

Smallpox was introduced into the neighbourhood of the town by the family of a farmer, who removed thither shortly after an illness by one of his employees of what was called by the medical attendant "Measles." The farmer, his son and daughter were attacked a day or two after their arrival. After five days' delay, they were removed to hospital (the wife accompanying them, though not attacked). Their house was disinfected. The man who did this duty was attacked later. No more cases occurred till 26th July, when a navvy in a common lodging-house in Warrington was taken ill, and a rash appeared on his body. The owner of the house, being suspicious of the nature of the rash, walked the man through the streets to the hospital, where he was detained. He was very ill. During his delirium he escaped the vigilance of the nurse, fled from the hospital, and before he was caught and brought back, had been at large in the town for six or seven hours. He was found by a constable nearly a mile from the hospital, and was brought back on foot. The man's case constitutes Group I. of Savill's groups.

During August a series of cases, as was afterwards proved, developed in the town. At first these were mistaken for German Measles and were treated at home, during which time plenty of facilities for intercourse in different ways was afforded. Around one of these cases, no fewer than 23 others infected were grouped from this common origin. The total accommodation available in the Borough Infectious Diseases Hospital at the commencement of the outbreak was 30 beds. For want of accommodation only 13 cases of smallpox could be received into hospital, and even then only by dangerously overcrowding the place. Sixty cases, in consequence, were left at home, these homes being scattered over the town. Primary vaccination had been well attended to in this population. It was estimated that 99·2 per cent. of the entire population had been vaccinated in infancy. Re-vaccination, however, had been neglected.

The Borough Hospital was close by inhabited houses. The street which led to its gates contained 79 houses and a population of nearly 800 persons, all of the working classes. Within a radius of 300 yards of the hospital, there was a population of 3,394 persons, not including the inmates of the workhouse, which was immediately adjoining the hospital. There were three open spaces around the hospital, where the children played and the neighbours gossiped.

The workhouse, to be more exact, was only 125 yards away from the smallpox block of the hospital. It had a population of 712 persons. In all, six cases of smallpox developed in it during the epidemic, and in all of them could a history of direct or mediate infection be tracked. It might be thought that this relative immunity was due to re-vaccination; but prior to the 19th September, when the smallpox cases were shifted to the new temporary hospital in Dallam Lane, only 59 of that 712 were protected by re-vaccination. In spite, therefore, of its proximity to the smallpox hospital, and of this other circumstance, only ·8 per cent. of the inmates were attacked, compared with 1·2 per cent. of the whole town. "Nor," adds Savill, "was there any other condition which could have prevented these persons from contracting the disease aerially had the principle of aerial convection been in operation."

The patients having now been removed to the new temporary hospital, a new set of circumstances was initiated whereby to test once more during the one epidemic the operation or non-operation of this aerial influence. The new hospital was by no means free from imperfections. It had no disinfector, consequently the clothes of the smallpox patients had to be sent to the old hospital for disinfection, and had to be brought back again; there were structural defects of a grave kind which enabled communica-

tions between the infected and non-infected to take place; and it was surrounded by a paling through and over which children climbed, and persons conversed and shook hands with convalescent patients. Around the paling boundary was the general play-ground of the children and the loafing-ground of the neighbourhood. Houses, to the number of thirteen, were within 100 yards of the centre of the hospital wards, and a total population of 1,075 persons within 500 yards. Of these 1,075 persons, 112, or 10·4 per cent. became infected during the months of October, November, and December. Savill worked out a table showing, first, the number of infected houses, the total number of houses in each area, and the percentage number of houses infected in a series of 100-yards zones up to 500 yards, and the same in relation to the quadrants, north-west, north-east, south-west, and south-east.

In the former it was shown that there was a certain gradational incidence as in former epidemics in other places, but that the percentage of houses infected in the 300–400-yards zone was greater than in that of 200–300 yards, whereas in the quadrant areas, the incidence was greatest in the south-east quadrant, next in the south-west, next in the north-west, and least in the north-east.

Looking at the question from the point of view of wind-direction, it was found from observations taken at the old hospital, 1,000 yards off, during October, November, and December, that the wind blew from the south-west on 32 days and from the south-east on 22 days, out of a total possible of 92 days. In other words, on 54 days the wind was from south-west and south-east. On the remaining 38 days it blew from the north on 8 days, from the north-west on 20 days, on one day from the east, on one from the south, and on 7 days from the north-west. If, therefore, other causes are excluded and aerial convection had prevailed, the north-east quadrant should have been most attacked, next the south-east quadrant, next the south-west, and least of all the south-east. But the actual result shows the very reverse: the south-east quadrant shows 14 per cent., the south-west 10 per cent., the north-west 9 per cent., and the north-east 6 per cent. Hence it would appear that the number of infected houses bore no relation to the direction of the wind.

Further investigation was made concerning the incidence of the disease among the workers in different works within 500 yards of the hospital, with the following result:—

There were ten of these works or factories within 500 yards of the hospital. The chief occupations were iron-making, fustian or velvet cutting, and brewing. The workers were for the most part adults, who

were healthy, and who had been primarily vaccinated. Generally speaking, there was seen to be a greater incidence upon the workers in the works nearest the hospital; at any rate, those within the 250–320-yards zone were more affected than those within the 400–500-yards zone. The Dallam Iron-work and the Dallam Brewery were both within the 300-yards radius, and both abutted on the lane from which entrance led into the hospital. The case-incidence in the iron-work was 3·5 per cent., while in the brewery it was only 1·1 per cent. Further investigation showed, however, that there were causes operating upon the workers in the iron-work which did not affect the workers in the brewery. There was proof that direct and mediate infection accounted for the higher rate found among the iron-workers than among the brewers. It has to be noted that it was not re-vaccination which protected the brewers, for they were not re-vaccinated until November 17th and 24th, when the bulk of them were done.

Savill's conclusions on the whole subject of this epidemic were, that the sources of direct and mediate infection were so common that there was no need to have recourse to the aerial theory to account for the outbreak and incidence of spread; that the disease seemed to spread directly along the lines of human contact; that the exemption of two large communities as the inmates of the workhouse and the employees of the brewery seemed to be against the view that conveyance by aerial currents was in operation at all. "On these grounds, therefore, and in view of the facts set forth in (his) Report," says Savill, "it may be affirmed that the diffusion of smallpox by aerial currents as above defined was not an appreciable factor in the Warrington epidemic; and further, that a close examination of the facts renders it unnecessary to assume any such hypothesis."

Glasgow Epidemic, 1900–1902.—*Vide* Report by Dr. Chalmers, Medical Officer of Health.

The history and progress of the outbreak was, shortly, this: Small-pox was introduced into the city in April, 1900, attained its maximum prevalence between January and March, 1901, began thereafter to decline, and the last sickening occurred on 29th June of that year. Early in November, however, it re-appeared, and during the spring months of 1902 it displayed considerable vigour. It still continues in the city. The number of cases recorded during the pre-epidemic period (between 21st April and 29th December, 1900) was 397; between 12th January and 13th July, 1901, 1,389; and between 16th November, 1901, and 3rd May, 1902, 469: in all, therefore, 2,255 cases.

From the early winter of 1897 until the outbreak in April, 1900, the

city was practically free from indigenous cases of smallpox, although an occasional case was reported from without. Smallpox, however, reappeared under the following circumstances: In an overcrowded one-apartment house in one of the poorest parts of the city (Calton), a man was found by the Medical Officer of Health to be suffering from a confluent attack, the symptoms indicating that the disease was well advanced towards the end of the second week. He had not been brought under medical observation until the day preceding, viz., the 9th of April. The patient had been a seaman on board the s.s. Hispania, which arrived at the port of Glasgow on the 18th March from Bombay, *viâ* Liverpool. The Medical Officer of Health of Liverpool had advised the Glasgow Sanitary Authority of the occurrence of smallpox on board this ship while in the port of Liverpool. In consequence, the crew of the ship while in Glasgow were kept under observation from 18th to 21st March, the time the ship lay in Glasgow. It was reported to the Medical Officer of Health of Glasgow that this man had been successfully re-vaccinated at Liverpool, and that he had sailed with the Hispania again on her outward voyage on 21st March. From facts ascertained some months later, however, it appeared that an unsuccessful attempt at re-vaccination had been made on him in the month of February while on the voyage from India, as smallpox had broken out on the ship. That he did not sail with the Hispania, although he had signed articles to do so, was proved by the subsequent history. After removal from the house in which he was living to hospital, he died.

Up till the 23rd April, no fewer than 11 cases were found to have been directly infected from this man, and of these some were residents on the common stair, some were inmates of the same house, one was his medical attendant, and one was a pawnbroker's assistant, in whose establishment articles from the house had been pledged. In all, five houses were invaded, in four of which overcrowding prevailed. Some of the infected persons had in the interval removed to other districts of the city, one had been lodging in a common lodging-house, another who had been living in the first infected house, left before the exact nature of the first patient's illness was discovered, and in the interval she had lived in three different places, for part of the time in two different private houses, and for part in a lodging-house. She was found to be suffering from smallpox when she presented herself for treatment at a public medical dispensary. Another was a worker in a rag-store. So far, therefore, it will be apparent from the distribution of the cases found, their migratory habits, their occupation, their connection with common lodging-houses, and the delayed recognition of their illnesses, that there was the making of an epidemic.

Fortnight by fortnight the number of cases increased, their incidence being first in the eastern district of the city in which is the smallpox hospital, and also in other districts of the city. The northern district was soon involved, and, later, was the area of a comparatively large centre of the disease. From the whole history of the epidemic, there were evidently unrecognised, ambulant cases of the disease going about. Men were attacked in public offices, infected from fellow-employees who were continuing at work while suffering from the disease. A group of cases in High Street was found whose infection was due to an unrecognised, non-medically attended, case of what seemed to have been hæmorrhagic smallpox; persons were found pursuing their vocation with the evidence of mild attacks of smallpox on their bodies.

During the fortnight ending 2nd of June, a definite attack of the eastern district of the city took place: in Steven Parade, a street immediately to the west of the smallpox hospital, and in streets in Bridgeton. At the end of the month, a congeries of cases occurred in London Road, due to the presence of undetected smallpox in a household in a tenement. In this tenement there were found eleven cases in seven households, and from the same source, five more cases were discovered, three of whom lived in the eastern, and two in the northern district.

During July and August, cases began to sensibly decline in numbers, but gradual dissemination of the disease continued by reason of unrecognised ambulant cases. It again became more active, as was expected, towards the end of November. It prevailed in other parts of the town as well as in the eastern. The City Poorhouse was invaded, evidently from undetected disease in a visitor to that institution. By mid January, 1901, the true epidemic period of the outbreak was reached. Milder forms of the disease, unrecognised, were common all over the city. On New Year's Day, for example, a case was reported in a street on the south side. Investigation of this case revealed that unrecognised cases of the disease existed in a house in Argyle Street, in the heart of the city, from which one case had developed smallpox in Aberdeen, one in Morayshire, one was pursuing her occupation in a public tea-room in the city; and so on. In short, it was found that this house had been in an infected state for five weeks prior to the New Year. Seven cases were known to have been infected from this house.

By the end of January, a violent outburst occurred. During the fortnight ending 26th January, 350 cases were reported, of which the eastern district alone contributed 256 cases, the rest being fairly distributed over the city. These cases formed two groups: one in the eastern and the

other in the southern district. Dr. Chalmers in his Report says of this outburst, that it required two factors to account for it, the free movement of mild unrecognised cases, and a susceptible population. Of 308 cases, the dates of whose sickening were known, it was found that 256 were infected about the Saturday of the New Year holidays, the 5th of January, when there is free movement about the city of large numbers of persons. "The outbreak" says Dr. Chalmers "is definitely related to exposure to infection during the holiday season. The localities involved correspond very closely with those in which isolated cases of the disease were known to have been occurring for some considerable time past; in those districts, therefore, there has been a succession of cases quite unrecognised owing to their mildness, but gradually, from their numbers, acquiring an explosive intensity, which only required a suitable occasion to show itself. This came with the holiday season, when intimate commingling occurred, and the mild cases had for the time being a newly established relationship." Then followed a temporary lull for four weeks, but in the last week of February, increase in prevalence was observed, which extended over a period of three weeks. From the 26th of January till the 9th of March, the total cases recorded was 978, of which the eastern district alone contributed 646, the southern 133, and the central 84. Put in other words, the eastern district showed per 10,000 persons an attack-rate of 13, the southern 2, and the central less than 3. After the end of March, small-pox was on the decline.

The city was quite free from smallpox from 29th of June till a new outbreak made its appearance in the northern district of the city in early November. An unrecognised mild case was once more the beginning of the mischief. The man attacked was a spirit salesman. He felt ill, and his ailment was called measles.

It was not till the 6th of November that diagnosis of smallpox was made by the medical officer of health, whose opinion was asked owing to some doubt as to the exact nature of the illness. The man was removed to hospital. By this time a little over 400,000 out of a total population of over 600,000 persons had accepted the offer of free vaccination, or had had the operation performed privately. By the end of November five cases were reported, one from a model lodging-house, the rest being associated with an address in Possil Road, a street in the extreme north of the city. It appeared that the man from the lodging-house was infected from the same address. During the enquiry into these cases, another was found who had sickened about the end of October, whose case during all the interval had never been detected, and who had been going about as

usual for most of the time. During the next fortnight ending the 14th December only four cases were reported. One was in the person of a patient who had evidently contracted the smallpox in London. He arrived in Glasgow from Tilbury in the Orsett Union, in which at the time smallpox was prevailing, on the 29th November, and sickened the following day. Two others were from the tenement in Possil Road, and in the fourth no antecedent source of infection could be discovered. A comparatively large infection took place in a model lodging-house in the northern district, due to a man who had been suffering from a mild unrecognised attack. From him twenty others were infected, and of these two were then living in other lodging-houses, one was a bed-maker in the same lodging-house but lived outside, one lived in Possil Road, and one in the east-end. Moreover, one of the two lodging-house residents lived in a lodging-house in the eastern district. The City poorhouse was again invaded, by the introduction of one who had been infected from a lodging-house. During February but few cases occurred in the eastern district, the model lodging-house in the northern district supplying the majority of cases. Of the eastern cases, one was the father of a child regarding whose illness attempt of concealment was made. By the end of that month, a further explosion of the disease in the eastern district took place. Of the 147 cases recorded in the fortnight ending 22nd February, no fewer than 102 were found to be in that district. By the end of the first week in March, however, the eastern recrudescence had gone down largely. A limited outbreak took place in connection with a hotel in a western district, twelve cases being attacked. One of the eastern cases was that of a woman who was employed in the hospital wash-house, and who had not been re-vaccinated before being employed. Thereafter the epidemic began to decline, and by the beginning of May but few cases were being fortnightly reported.

Attack-Rates.—The eastern districts had higher attack-rates than any of the other districts of the city. In the Greenhead and London Road district (No. 7) it was 9·9 per 1,000, fully six times greater than those of other districts, and fully four times that of the city generally; Barrowfield District (No. 8) came next with a rate of 6·4 per 1,000; District 11, in which the outbreak began originally, came third. Viewed from the point of view of cases to population, District No. 7, with a population of 66,297, had 660 cases; No. 8, with a population of 27,696, had 179 cases; while the Bellgrove and Dennistoun District (No. 5), with a population of 79,211, had 224 cases. These are districts in the eastern end of the

city, the population of Bellgrove and Dennistoun District being, however, of a better class. But districts far removed from the smallpox hospital had by no means few cases: that of Hutcheson Square, for example, with a population of 70,229, had 146 cases; and that of Kingston (No. 19), with a population of 40,407, had 63 cases. Both of these districts are on the south side of the river, and are much further removed from the smallpox hospital.

Hospital Influence.—Dr. Chalmers constructed a Table covering several years, during which smallpox was epidemic in Glasgow. This Table is here reproduced.

Proportion from each Administrative District of the Total Cases of Smallpox occurring in Glasgow in Several Years.

Year.	Total cases.	Percentage of Total Cases.						
		East.	Central.	South.	North.	West.	South-Side.	N'th-West.
1900—1901	1,759	60·4	12·3	13·6	7·0	3·0	3·1	0·6
1892	78	28·2	19·2	26·9	3·9	20·5	1·3	...
1893	386	45·9	24·7	9·7	12·8	3·8	0·8	2·3
1894	49	32·7	36·7	16·3	8·2	2·0	4·1	...
1895	243	33·4	14·0	9·0	5·8	36·2	0·8	0·8
1896	5	...	...	...	...	...	...	...
1897	59	57·6	3·4	32·2	5·1	...	1·7	...
Percentage Population, 1901.		23	15	17	22	8	8	7

Of this Table, Dr. Chalmers remarks that "in each year in which smallpox has been present the proportion of cases contributed by the eastern district has been uniformly in excess of the proportion of the population residing there"; and he adds "the central, southern, and western divisions in occasional years present a similar excess, but this is due in most cases to the circumstances under which the several outbreaks were introduced. The excess in the eastern district is constant, and in none of the other districts is this feature present."

The prevalence of the disease in the eastern district in the present epidemic took place when the number of cases in the Smallpox Hospital was comparatively limited. Dr. Chalmers argues that it is reasonable to assume that if a simple aggregation of smallpox creates an element of risk to surrounding populations, that risk should increase with the density of the aggregation, with the result that an exaggerated prevalence ought

to be noted in those districts most exposed to that influence, and in excess of those districts which are beyond its influence. In the preceding Table it is clear that, based on the form of reckoning used in the Table, in the present epidemic the eastern district showed by far the highest proportion of cases. The same is true of the years 1893 and 1897, but is only relatively true of 1892, for in this last year the percentage of total cases for the southern district very closely approaches that of the eastern. In the years 1894 and 1895, this increased proportion in the eastern district relative to other districts is not maintained: in the former of these two years the central district, and in the latter the western, contributes respectively higher proportions than the eastern.

In attempting to obtain any indication of relationship between the volume of infection contained within the Smallpox Hospital, distinct from the volume of infection which may be reasonably assumed to follow in the wake of a converging stream of patients and infected clothing, together with the opportunities of contracting infection from non-detection or delayed recognition of mild cases, Dr. Chalmers says that if a numerical relationship is established between the cases which occurred before, and those which occurred after, the beginning of 1901, a figure of 1 to 3·5 would express the proportion for the city generally. Compared with that proportion, the corresponding proportion for the eastern district would be 1 to 3·9, that for the northern district 1 to 3·6, and that for the southern 1 to 4·9. Put in other words, the proportional figure for the southern district shows a five-fold increase during the epidemic period, that for the eastern district a four-fold increase during the same period, and negligible differences are apparent in the proportional figure for the northern district. It has further to be observed that the cases in the southern district are much further removed from the Smallpox Hospital than any part of Bridgeton which is nearest the hospital. The only legitimate deduction from these facts, therefore, is that while the proportional figure for the eastern district is relatively high, the operation of widely distributed opportunities of infection, known to exist during the currency of the pre-epidemic and epidemic periods, has to be seriously reckoned with.

From a consideration of the proportion of the cases in the eastern district during the epidemic period, particularly of those in the four weeks ending 23rd March, there would seem to be some suggestion of a definite time relationship with the numbers under treatment in the hospital. By the 8th March the maximum number of cases in hospital had been reached, viz., 522. When, however, a comparison of the fortnightly

admissions with the numbers in hospital is made, the temporary impression is dissipated. For example, 67·5 per cent. of the cases occurring in the fortnight ending 16th June, 1900 happened at a time when the number of patients in hospital was 67 only. Dr. Chalmers' conclusion was that the material of this epidemic did not warrant him in saying that the infection of a neighbourhood contiguous to a smallpox hospital was in any definite way proportioned to the volume of infection within the hospital. When the unexpectedly large number of cases broke out in the east end of the city, in the immediate neighbourhood of the Smallpox Hospital, the number of cases in hospital barely exceeded 30 daily. Later, increase of numbers in hospital was associated with increase of numbers in its neighbourhood, but the proportion to the total volume varied on each occasion only by a few per cent., while the numbers in hospital were multiplied from six to sixteen times. While, therefore, it might be supposed that there was a general correspondence between the proportion of cases occurring in the neighbourhood of the hospital, and the numbers dealt with in hospital, no such correspondence was discoverable during the epidemic period, or even during the period of the rising epidemic. On this point Dr. Chalmers says: "The investigation throws no light on the channels through which influence is exercised, except what is of a negative character. The eastern cases began when there was no pressure on ward space; they re-appeared at a period of the recrudescence when this was being specially guarded against; and but few of the cases in this period recurred in formerly infected tenements. The topographical relationship of the hospital to the surrounding population outside the quarter of a mile radius does not admit of any discrimination between the effect of aggregation and the precedent volume of traffic, both in patients and infected clothing, through the main thoroughfares of the infected district. But a survey of the whole circumstances leads inevitably to the conclusion, that the excessive prevalence in the eastern district has established the unsuitability of Belvidere for the continued treatment of smallpox."

One feature of this epidemic (repeated, moreover, in other recent epidemics elsewhere) remains to be mentioned. The number attacked between the ages 25–35 was much in excess of the number at any other age-period. From this fact alone, the lesson which the epidemic teaches is that communities who rely solely on primary vaccination in infancy cannot be expected to present an immune front to smallpox contagium.

Epidemic in Orsett Union, Essex.—September, 1901, to June, 1902. (*Vide* paper by Dr. Thresh on "Smallpox Hospitals and the Spread of

Infection," Trans. Epidem. Soc., London, Vol. XXI., N.S., p. 101, *et seq.* Report to Local Government Board on "Epidemic Smallpox in the Orsett Union, 1901–02," by Dr. G. S. Buchanan.)

The district embraced under the Orsett Union in the County of Essex has been the arena of different epidemic attacks of smallpox during the last decade or more. It suffered to some extent in the pandemic wave of 1871; again in 1877, when the disease caused 16 deaths; again in 1884 and 1885; again in 1892–93, when between 60 and 70 cases were recorded; a few cases appeared in 1894, 1895, and 1896; two cases in 1898; and two in 1900.

But between 1897 and 1900, with the exceptions above noted, smallpox was unknown in the Union. The outbreaks in 1893 and in 1895 were attributed to infection from the floating Smallpox Hospitals of the Metropolitan Asylums Board, which are anchored in the Thames off Purfleet, having been placed there in 1884.

During the epidemic of 1901–02, that under special consideration, of the 17 parishes which compose the Union of Orsett, 12 were more or less invaded, those unattacked being agricultural parishes along the northern boundary of the Union.

The number of smallpox notifications from August, 1901, till April, 1902, both inclusive, was 443, of which 117 occurred in the parish of West Thurrock, 157 in Grays Urban District, the next highest number being in East and West Tilbury, 31 in South Ockendon, 28 in Aveley, 31 in Stifford, 18 in Orsett, and smaller numbers in the others.

Geographically, the Union extends from east to west for about fourteen miles, and from north to south for about seven miles, the Thames forming its southern boundary. The most populous parts of it are those by the river, especially Grays Urban District, the parish of West Thurrock to the west of Grays, and the parishes of Little Thurrock and Chadwell St. Mary to the east of Grays. In these localities are many works by the riverside, chiefly cement works. In the parish of Chadwell are the Tilbury Docks. The Orsett Rural District is mainly agricultural, but some of the inhabitants of it repair daily to their work in these works by the river. Purfleet is nearly opposite, but a little to the west of, the hospital ships, which are, however, moored nearer the opposite side of the Thames. It contains chalk quarries, paper mills, oil and storage works, and saw-mills. It therefore attracts for employment many persons from different parts of the district, who working daily in the works live in other parts of the Union. Between Purfleet and the hospital ships is moored the reformatory ship Cornwall, and to the west of the hamlet

of Purfleet are the barracks containing the garrison. It will thus be seen that the population most affected during the epidemic was that along the riverside districts.

The population of West Thurrock numbers 2,585, and had 117 cases, the population of the rest of the Union was 30,578, and had 321 cases. The attack-rate per 1,000 in West Thurrock, therefore, was 45, and in the rest of the Union it was 10·5, or in the former four and a half times higher than in the latter.

For convenience sake, the parish of West Thurrock may be divided into Purfleet and West Thurrock. Purfleet consists mainly of workmen's cottages, 110 in all, chiefly of the cottage type. Near the cottages are the works already named. The garrison numbers approximately 215. The training-ship Cornwall contains about 266 persons. For reasons which will emerge later, it is advisable to keep separate the population of Purfleet from those of barracks and training-ship. The population of Purfleet hamlet was 479; that of the garrison and training-ship combined, 480. East of Purfleet lies the rest of the parish of West Thurrock, the populous part of which lies mainly on either side of the road from Purfleet to Grays. The houses on and near this road stop about a point half a mile from Purfleet, and therefore the hamlet of Purfleet is isolated or separated from West Thurrock by a strip of open country. The hospital ships are placed in the river about 700 yards from the nearest point of the parish. Reckoning the distance of Purfleet hamlet from the ships as a centre, it is just within the three-quarter-mile radius. Between this and the two-mile radius, the population of West Thurrock is very scattered and small in number. Just outside the two-mile radius lies the village of West Thurrock. Just within and on the border of the three-mile radius are the populous parts of the parishes of Aveley and Stifford, the population of which is 2,136 persons.

Between the third and fourth-mile radius are the town of Grays and the village of South Ockendon, which together have a population of 14,890 persons; and beyond the four-mile limit is the remainder of Orsett Union, with a population of 13,552 persons. The population of Tilbury Docks, which is of a closely aggregated character, numbers 4,877.

It is further necessary to state that the hamlet of Purfleet is artificially divided into two sections by a curve, equivalent to a right angle, of the London, Tilbury, and Southend Railway. One portion, therefore, lies to the west, and the other to the south of the railway.

Hospital Ships and Communication with the Essex Shore. — While

investigating the epidemic of 1893–95, Dr. Thresh came to the conclusion that some influence, out of the usual, was operating to cause the epidemic: in other words, that neither direct nor mediate infection, nor both combined, could account for the spread of cases. Further enquiry, however, elicited the fact that there had been a certain amount of intercommunication between the Essex shore and the ships. Thereupon, at the request of the Essex County Council, the Metropolitan Asylums Board altered the local arrangements at the ships so that all intercommunication would be prevented in future. Since that time, Dr. Thresh believes that none has taken place, save the probable surreptitious visit of a man to his sweetheart. In view of the above intercommunication, Dr. Thresh found that he could not well establish the view he entertained, that the spread of smallpox from the ships was due to aerial dissemination. But now that this intercourse had ceased, and in view of the isolated position of the ships, the study of the influence of aerial convection, if any, became much more simplified.

Outbreak of Epidemic.—The first case notified in the epidemic now under consideration occurred at the end of August, 1901, in the person of a man who worked as a signalman on the railway at Purfleet, at the point nearest to the hospital ships, but who resided at Grays. It was shown that this man was in the habit, periodically, of swimming in the Thames more or less near the ships, and that he had been doing this two or three weeks before he sickened. There was no history of his having been exposed to antecedent smallpox. The next two cases in Grays, notified also in September, were no doubt infected from this man. On September 13th, two notifications were received from West Thurrock. They were of the parents of this man; they had been visiting him at Grays when he was sickening from the disease. On the 15th, a third case was notified from the same village in the person of a man who worked at Purfleet Saw-mills. He had had, so far as could be discovered, no relations with the first case, nor, indeed, with any known antecedent case. On the 21st, a case was notified from Paper-Mill Cottages, West Purfleet. At the end of the month, three cases were notified from the parish of South Ockendon. They appear to have been infected from a man who had suffered from what at the time was believed to be chicken-pox, which developed a fortnight after a visit to the signalman, when he was sickening. It is thus apparent, that while no trace of antecedent infection from any person or thing was discoverable in the cases of the signalman and saw-mill worker, all the other cases in different parishes had been infected from the

signalman. In the week ending October 12th, four cases were notified from Purfleet: one of a male who lived in West Purfleet, the other three, of a man aged 39, and two children, aged 11 and 5 respectively, who lived in Paper-Mill Cottages, where the case formerly reported on September 21st resided. These cottages consist of two rows of workmen's dwellings near the riverside works, the rows being some little distance from each other. No new cases were notified during the next two weeks. But in the week ending November 2nd, five cases were notified, three being in Purfleet, and two in Tilbury Docks. The cases in Purfleet were those of a boy aged 5, a girl aged 13, and a man aged 24. They all lived in the Paper-Mill Cottages. It is noteworthy that Tilbury Dock population was infected about the end of October. Indeed in the month of November, the district surrounding Tilbury Dock contributed eight cases locally to the Orsett epidemic. But it did more. As has already been noted, the influence of the Tilbury infection was felt very much further afield. On the 29th of November a man arrived in Glasgow from Tilbury, and sickened with smallpox the day after, the rash appearing two days later. Five more cases were recorded by the end of the week dated November 9th. There was one case in each of five different places in the Union, four of them occurring in neighbourhoods already infected. One case was in Aveley: this was a man who worked daily in a chalk quarry in Purfleet; another happened in Purfleet in the person of a man aged 39, who also lived in Paper-Mill Cottages, from which already 7 cases of smallpox had been removed. A third was in Tilbury Docks, the fourth lived in Stanford-le-Hope, and the fifth in the Grays Urban District.

Before proceeding further, it will be well to account, if possible, for the nine cases which occurred in Purfleet between September 21st and November 9th. It has been said already that no trace of antecedent infection could be discovered of the first case: the woman had not been away from Purfleet about the time she must have been infected. The three cases notified on October 10th had, in common, the opportunity of contracting infection from an un-notified case, presumably unrecognised, in a person who about a fortnight earlier had had all the signs of a mild attack. Her infection, however, could not be traced to antecedent infection, although in the middle of August a child of hers had had an illness believed to be chicken-pox. Of the five others, no facts could be ascertained which pointed clearly to relation with previous infection, although they lived in one of the two rows of cottages in which the case notified on September 21st lived. It must be observed, however, at this stage, that it is very significant that in these very rows of cottages there

should have been a missed case, as it makes it extremely difficult to get over the suspicion that, unknown to any of the individual persons, infection may have unwittingly taken place. The child of Mrs. C.—the missed case—was ill in August from chicken-pox, and spots appeared on its body. Buchanan, in his investigation, concluded "that neither the history nor the date of onset of Mrs. C.'s illness gave much reason to suspect she had been infected through this child, even though the latter had suffered from smallpox." The only observation that follows this is, that while it is quite true that immediate sequent infection may be apparently untenable from the dates, it is not beyond reasonable possibility that she was in the line of infection. This child's chicken-pox occurred in the "middle of August," the mother's attack of undoubted smallpox took place "about a fortnight earlier" than the 10th of October, which takes us back to the 26th or 28th September as the date of the mother's sickening. It is not unreasonable to urge that the case of E. B., living in the same rows of cottages, and whose case was notified on September 21st, was infected either from the mother, Mrs. C., during her period of sickening, or from her child during its convalescence. Neither is it beyond the bounds of reasonable possibility that in the case of the mother, Mrs. C., her infection was merely a deferred infection from infected clothing from her child. On this point it seems to me impossible to get rid of the fact that in two rows of cottages, relatively near one another, eight cases of smallpox are discovered within a period of forty-nine days in sequence to one another, and of the likelihood that unknown intercommunication between these eight persons, Mrs. C., the missed case, and her convalescent child, did take place. This does not even presume the absence of the most absolute good faith of all parties concerned.

In the week ending November 16th, no further cases were notified; but in the next week, November 23rd, 23 cases were notified, of which 9 were in Purfleet, 6 in West Thurrock, 1 in South Stifford, 3 in Tilbury Dock, 1 in Stanford-le-Hope, 1 in South Ockendon, and 2 in Grays. Buchanan in his report makes the significant remark that as the epidemic progressed in Purfleet, inquiries of a minute character as to local sources of infection were seldom made by the sanitary officers, but it was well ascertained that the dwellings in which the bulk of cases broke out were groups of workmen's houses, such as Paper-Mill Cottages and others. Ere long, almost any dwelling newly attacked by the disease had in its neighbourhood another dwelling in which the disease had recently been existent. It is a reasonable conclusion, therefore, that unwitting infection may have taken place among persons visiting houses in which infected

persons were sickening from the disease, or before disinfection had been completed. In few cases did it emerge that suffering persons had lived at home for several days before medical attendance was called; in one instance only was a man found at work while suffering from the disease. Chicken-pox did not prevail extensively in Purfleet during the epidemic, so far as was known. Notification of chicken-pox became compulsory, however, at the end of December, 1901, and from December, 1901, till June, 1902, 101 cases in all were notified in the Orsett Union. An analysis of that figure shows that only 1 case was notified from Purfleet in May, 1902, 16 from West Thurrock, 15 from Tilbury Dock, 11 from Stanford-le-Hope, 38 from Grays urban district, 2 only from the rural district of the Union, and the remainder from the other parishes. Among the 479 persons constituting the population of Purfleet, there were 47 cases of smallpox, showing an attack-rate of 100 per 1,000 of population. In the remainder of West Thurrock, population 2,046, the number attacked was 70, the attack-rate being 33 per 1,000. The disease, therefore, was three times as prevalent in Purfleet as in West Thurrock.

In the eight months during which this epidemic lasted, the attack-rates for the different parishes and the remainder of the county were as follows:—

	Per 1000.	Ratio.
Grays Urban District	11·4 ...	19
Orsett Rural „	14·4 ...	24
Orsett Union	13·1 ...	22
Remainder of County	·6 ...	1

These results, in terms of ratios, show that up till the end of March, 1902, smallpox was twenty-two times more prevalent in the Orsett Union than in the rest of the county, in the Orsett Rural District twenty-four times more prevalent, and in the Grays Urban District nineteen times more prevalent.

The attack-rates within different radii, reckoned from the hospital ship, put summarily, are as follow:—

Between seven hundred yards and one-and-three-quarter mile radius	110
„ three-quarter-mile and four-mile radius in West Thurrock	33
In Aveley and Stifford	23
Between the three-mile and four-mile radius	19·5
Beyond the four-mile radius	6·6

Hospital Accommodation.—It may be said at once that there was efficient hospital accommodation within the Union. The hospital is situated in the northern corner of the parish of Little Thurrock, about one and

a half miles from Grays, and about the same distance from Orsett village. It stands in a plot of five and a half acres of ground, is comparatively remote from inhabited areas, and there are but few dwellings within a relatively short distance. There is one house within a quarter of a mile, three or four between that distance and half a mile, one group of houses within the mile, and the town of Grays lies within the mile and a half limit. The populations of the small groups of dwellings number forty.

Twenty beds were available in the hospital when smallpox broke out in Purfleet, but owing to rapid increase in numbers, temporary accommodation had soon to be put up. Counting the temporary accommodation, the number of available beds was 65, which number, however, during several occasions, was exceeded. The highest numbers ranged from 70 to 104 and 110. The hospital was overcrowded. Several workmen employed on the temporary buildings were attacked, but only one other person working or living near was infected, so far as was learned. Dr. Thresh says of the hospital, "that the distribution of smallpox in the parishes around does not appear to indicate that this hospital has had anything to do with the aerial dissemination of infection, but it is just possible that the influence, if any, is masked by the effect of other and more important factors."

Isolation of Cases.—The first cases in the epidemic were received into the hospital ships by arrangement. When on September 23rd the Orsett Fever Hospital was utilised for smallpox, all notified cases were isolated in it with the exception of 8 cases who were too ill to be removed. Patients were removed from their homes to the Orsett Hospital in ambulances. Complaints of the men in charge of these stopping at public-houses, and of children standing round the vehicles on these occasions, were made. One driver who had not been re-vaccinated was attacked by the disease. Dr. Thresh says that he had not met with a case which could be said to have contracted smallpox from an ambulance, or one in which the ambulance routes distributed infection.

Infected Bedding and Clothing.—At first, infected stuffs were collected and burned, because there was no disinfecting apparatus in the district. A "Thresh" disinfector was got later, but even then it was, at times, unable to cope with the material to be disinfected.

Disinfection of dwellings was effected by fumigation with sulphur. Complaints regarding house disinfection were made to the Local Government Board by the West Thurrock Parish Council, to the effect that it was not efficient.

Contacts.—The plan at first adopted was to attempt to confine in-doors the members of all families from which smallpox had been removed, on condition that each such family so treated should receive a weekly payment of £2 during the period of isolation. With one or two exceptions, the agreement seems to have been complied with. Contacts generally escaped infection: indeed, in one case only was a contact infected. Later in the epidemic, the sanitary officials changed the mode of dealing with contacts. They insisted that for two days at least the families of those attacked should remain at home, and for a time afterwards be kept under observation. Buchanan informs us, however, that as the epidemic progressed, this oversight was maintained "in a somewhat unequal and irregular fashion."

Condition of Population of Orsett Union with respect to Vaccination and Re-vaccination.—Generally, it may be said that the proportion of infants whose vaccination was not finally accounted for increased rapidly after the year 1891. During the six years, 1895–1900, more than a third, and in three of these years more than half, of the infants whose births were registered in the Union were not vaccinated at the end of 1900. The "conscientious objector" flourished in Orsett. Of the adult population, Buchanan was of opinion that it did not comprise any exceptional proportion of unvaccinated.

Age-incidence of those Attacked.—Of the 519 persons attacked, 398, or 76·6 per cent., were between the ages of 15 and 25; 108, or 20·8 per cent., below the age of 15; and 13, or 2·5 per cent., were at 65 years or over. The death-rate among unvaccinated children was 24·6 per cent., or excluding three cases of infants in whom vaccination was successful after exposure to smallpox, 22 per cent. No vaccinated child died.

Re-vaccination was largely accepted by the population because of the protection it was seen to give. By the end of March, 1902, 6,753 persons had been revaccinated by the public vaccinators alone. Conversion to re-vaccination seems to have been tardy, but fairly general.

Causes of Epidemic.—In this epidemic, failure to promptly isolate those attacked could not be said to be one of the causes of the outbreak. The occurrence, however, of mild, unrecognised cases in different centres undoubtedly contributed to spread the disease. In some of these cases the victims were found continuing their ordinary avocation. Moreover, there were in certain instances mild cases of undoubted smallpox in which there was no medical attendance, and there was the disastrous result of

mistaken diagnosis of smallpox for chicken-pox. All such cases, found as they all are in every epidemic, have no inconsiderable effect in spreading infection. Visitation of friends to patients in hospital was also a factor, on account of their refusal to be revaccinated. Thresh informs us of cases arising from this cause, due, he believes, to the absence of dread of smallpox by the poorer classes, which prompts them often to visit hospitals out of mere curiosity, or on the chance of seeing some one they know. During this epidemic too, while the temporary buildings were in course of erection, workmen contracted infection to the number of five, and in one case a workman infected his brother. Intercommunication between families at the time when individual members were incubating smallpox could not be ignored as helping to spread infection, and mediate infection by persons acting as passive vehicles of the contagium had to be borne in mind. In a wide district like this, which contains different groupings of population, and in which persons from one district are daily employed in another centre, spread of the disease by infected fellow-workmen had to be reckoned with. To a considerable extent, therefore, the range of spread is determined by factors such as these, and there is not a little evidence to prove that all of them operated in this way during the currency of this epidemic.

But it is alleged that, besides direct and mediate sources of infection, there appeared some other factor, not embraced among these, which originated and spread the outbreak. Dr. Thresh has no hesitation in declaring that factor to be aerial influence from the smallpox hospital ships in Long Reach. Buchanan, after investigation of the facts, arrived at the conclusion that "as regards the influence of the hospital ships upon prevalence of smallpox in Purfleet during this epidemic, we have to choose between aerial convection or nothing: there is here no question of infection, direct or mediate, through human intercourse or traffic. As to the latter alternative, I would say at once that if the presence of the smallpox ships in Long Reach had no concern with the Purfleet epidemic, then, while making every allowance for opportunities of local spread of the disease, I am nevertheless quite unable to suggest any reason for the extraordinarily heavy and long-sustained prevalence of smallpox there. If, on the other hand, the ships did exert influence on the epidemic, infective particles being from time to time, under favouring meteorological conditions, conveyed to the area of Purfleet and there enforcing smallpox already prevalent, or setting smallpox going anew, then not only is the Purfleet experience intelligible, but the hypothesis invoked to explain it is one that has been shown to be necessary, in our present knowledge, if the

characteristic peculiarities in the distribution of smallpox in the neighbourhood of smallpox hospitals are to receive anything approaching a sufficient explanation." Thresh, however, seems to incline to the belief that it is necessary to invoke the aerial theory of convection not merely to cover the Purfleet incidence, but a much larger area than seems to be embraced within Buchanan's consideration. He says (op. cit., p. 110), "the extent of the area around a smallpox hospital which may be affected directly and indirectly by the hospital is apparently much larger than has hitherto been supposed. In the case we have been considering, the influence is probably being felt at a distance of fully three miles, and the presence of a belt of water half a mile in width is powerless to arrest the spread of the contagion." It will be seen that in the foregoing statement, all the old question has been mixed. It will be observed, that he includes under hospital influence, *direct and indirect effects.* It appears to me, in discussing the value of the doctrine of aerial convection with regard to any given set of events, that direct and indirect effects must be clearly dissociated if we are ever to hope to be able to appraise the true worth of the doctrine. Even in this epidemic Buchanan will not go the length of Thresh respecting the range of action of aerial influence of the ships upon the Orsett Union. He frankly acknowledges (what must be obvious to every one who makes an intimate study of the facts of smallpox epidemics in which the theory of aerial influence has been invoked to account for the facts) that the doctrine of infection disseminated by the air from a hospital must be based upon a balance of probabilities, as the doctrine cannot be proved by direct experiment. Says Buchanan very truly, "from the nature of the case, proof, in a strict sense of the word, is unattainable. For proof to be afforded it would be necessary first to ask whether during the epidemic there was evidence that the ships occasioned an intensity of infection in their neighbourhood, graduated from centre to periphery, and comparable to that observed within a mile of other hospitals on other occasions. This cannot be answered: the ships have the uninhabited Dartford marshes to the south of them; there are, practically speaking, no dwellings within a mile save those of Purfleet." But he believes, as tending to proof of this intensity, that the experience of the men employed in the erection of the temporary buildings on the Dartford marshes close beside, but separated from, the administrative buildings by a close fence, who were attacked by smallpox to the number of sixty, cannot be overlooked. Buchanan does not go the length of affirming that all of these men were attacked solely by aerial influence, because some of them were found to be suffering from smallpox at the time they were actually

being employed. In the same direction he cites further the experience of crews of ships who pass these hospital ships in their passage up and down the Thames, or are compelled by reason of fogs in the river to anchor more or less near them for variably short periods of time; and in particular, the case of the s.s. Stuma, under the latter category, in which two cases of small-pox occurred within fourteen days after that ship had been moored alongside the hospital ships. Indeed, Buchanan cannot follow Thresh with respect to the extent of range of influence of the hospital ships. He points out very aptly, that "an important element of uncertainty has to be reckoned with"; for although the gradational incidence does not follow lines of human intercourse between the hospital ships and the areas attacked, it does follow (and, it appears to me, very markedly follows) lines of human intercourse and traffic to and from Purfleet in which the epidemic originally broke out, and in which it prevailed so extensively and so sustainedly. From a consideration, therefore, of all the facts, it is not surprising to find Buchanan coming to the following finding:—"I am unable to consider aerial convection otherwise than a possible factor in the spread of smallpox in localities considerably more than a mile away from the hospital ships: one that may or may not have operated, and which, if it did operate, may or may not have materially conduced to spread and maintenance of smallpox in the areas in question. . . . . The facts available do not suffice to indicate whether prevalence of smallpox in inhabited areas distant from two to five miles or further from the hospital ships has been realised in material degree, or at all, to infection conveyed aerially from the ships to those areas."

Relation of Number of Cases of Smallpox in Hospital Ships to Outbreak.—It will be remembered that the first case of the epidemic was notified in the week ending August 31st, in the person of the Purfleet signalman. During the month of August, while 14 cases were already on the ships, 58 more cases were admitted, and between November, 1901, and June, 1902, the average daily number on the ships was 164, the minimum and maximum daily numbers being 97 and 271 respectively. It will be thus apparent that the Purfleet signalman was attacked when there was relatively a small number of patients on the ships. Whether or not the increasing numbers on the ships contributed to the spread of the epidemic, in view of the local agencies at work in the way of direct and mediate infection, appears to me to be a matter incapable of proof. But the aerial doctrine may be tested in connection with the hospital in connection with the Union itself. As has been observed, the number of beds, counting

those added in temporary buildings, was 65 after January; but after that date it was always more or less overcrowded. It is difficult, except by extreme stress of circumstances, to justify the putting of 104 or 110 patients into a hospital meant to hold only 65; but it was done. In spite of this overcrowding, however, we have the testimony of Thresh that it did not seem to have anything to do with the dissemination of the disease, or that if it did exert any influence, that was masked by other and more important factors. It is quite true that within three-quarters of a mile of it there were only forty resident persons: but even here, one asks, why should aerial influence not prevail as it is alleged to have done from the hospital ships.

Meteorological Conditions Relative to Ship Influence.—Thresh thinks that certain meteorological conditions have an important bearing upon the outbreak and spread of the disease in this epidemic. During the eight months in which it existed, the prevailing winds were from south-west and from west-south-west: thus the winds blew from the ships in the direction of Purfleet, and especially over South Purfleet. In this way he accounts for the relatively high prevalence in South Purfleet and the relatively low prevalence in West Purfleet. Buchanan thinks it worth noting "that during the beginnings of the epidemic in Purfleet—in September, October, and the early part of November, when the cases to which I have alluded (the nine cases in Purfleet) were occurring—the weather, as a whole, was characterised by an abundance of calm, almost windless, days and nights, many of them accompanied by fog." He adds: "It is easy for anyone acquainted with the hospital ships and their method of ventilation to realise the large volume of warm air derived from the wards, accompanied by suspended particulate matter, which must rise steadily upwards from the ships on days of this kind, and to understand that particulate matter thus conveyed by the air may, without great dispersion, be wafted by gentle air currents, ultimately to settle, now, for example, on Purfleet, now on Dartford marshes, at one time towards Erith, or at another on the surface of the river. A moderate or strong wind on the other hand might be expected to cause rapid dispersion and removal of particulate matter from the ships." In the Table of Meteorological Observations taken at the Royal Observatory, Greenwich, for the four months September to December inclusive, it is noteworthy to observe that during the first eight days of September, during both night and day, except on the 8th of September, when apparently for a short time only the wind was S.S.W., the wind was mainly easterly, that is to say, it was either N.E., E.N.E., N.N.E., or

E.S.E. From the 9th to the 15th of September inclusive, it was mainly from the N., or northerly directions, and only on the 9th and part of the 10th and 11th of September was it S.W., or W.S.W. For the first 14 days of September, therefore, the wind was not a favouring wind to support the aerial convection theory. If, therefore, at the beginning of the epidemic the hospital ships exercised any influence on the outbreak of the disease in Purfleet, the wind was not a favouring factor. It seems to me, that this is of the utmost importance, when we consider the fact that the aerial influence of the hospital ships was supposed to be exercised in the causation of these nine cases. Upon this wind movement, too, Thresh bases his reason to account for the relatively less attack of West Purfleet. Buchanan states that the relative freedom of attack was to be partly accounted for by the fact that several of the West Purfleet population had already had small-pox, several had been re-vaccinated previously, and many of the infants had been primarily vaccinated. At the same time, it is of consequence to note, as traversing the view entertained by Thresh regarding the immunity being due to wind conditions, that one of the very first cases to be attacked in the outbreak, indeed, the second of the nine cases upon which so much importance is placed as indications of aerial influence, was a man, aged 21, who lived in Dell Cottages, West Purfleet: this being one of the cases in which no exposure to antecedent infection was known. Some importance has been attached by Thresh, as proof of the aerial influence of the hospital ships in the causation of former outbreaks in the Orsett Union, to the gradational incidence of attack of areas in graduated distances from the ships as a centre. It appears to me that no evidence, except in a very general way, is of any value prior to the outbreak of 1895, owing to the known existence of direct communication from the ships to the Essex shore; in other words, that under circumstances of possible direct infection, no discrimination can be made between infection which might have been conveyed directly from the ship, and that from aerial dissemination, since the one could not easily, if at all, be distinguished from the other. Therefore such evidence as has been adduced from the experience of former epidemics to prove aerial infection from the ships must be estimated only for what it is worth, and that, in my opinion, is nothing as valid evidence. It is only when we start upon our inquiry with the certain knowledge—if that even now is possible—that intercommunication between the ships and the Essex shore has ceased, that we can pretend to try to unravel this somewhat difficult problem. Therefore, it is only by sifting the facts of the present epidemic very carefully, and by criticising their value, that we shall be able to arrive at a reasonable conclusion one way

or another respecting the likely operation of aerial convection of infection from the ships.

The Influence of the Hospital Ships with relation to Epidemic.—In pursuing this line of argument, it is essential that certain facts already mentioned must be recapitulated. We start from the first case, that of J. P., the Purfleet signalman. His case was notified in the last week of August. He lived in Grays town. He swam occasionally in the Thames near the hospital ships. The next two cases in sequence, as known to the sanitary authorities at the time, were this man's parents, who lived in West Thurrock, but who had visited their son while he was incubating the disease. Their cases were notified on September 13th. The third case had not been in relation with J. P., nor, so far as known, with any antecedent source of infection. He worked in Purfleet saw-mills. His case was notified on September 15th. Then on September 21st came the case of the woman who lived in Paper Mill Cottages, in South Purfleet, regarding the source of whose infection nothing was clearly found out. Then on October 6th there is the case of J. G., a man of 21, who lived in Dell Cottages, in West Purfleet, the source of whose infection could not be discovered; then on October 10th three more cases are reported from Paper Mill Cottages, followed by another case from the same cottages on the 28th, another from the same place on the 29th, another on the 30th, and on November 9th still another from these same Paper Mill Cottages. On this date also is notified a case from Aveley, in the person of a man who lived there but who worked in a chalk quarry in Purfleet. It was probably when inquiry was being made respecting the sources of infection of the Paper Mill Cottages cases that discovery is made of the "missed" case, and of the history of "chicken-pox," dating back to the middle of August. Three of the cottage cases had opportunity of contracting infection from this woman. But of the other five cases in these cottages, "neither Dr. Corbet nor Dr. Dunlop who attended them had in any instance ascertained facts clearly pointing to an antecedent case or cases as cause of infection, nor could I (Buchanan) trace any relationship with such cases." Besides these cases named, three other cases were notified from another part of the district at the end of September. They related to persons who appear to have had contracted infection from a man who had had what was taken to be "chicken-pox" fourteen days after a visit to the Purfleet signalman, when he was sickening from small-pox.

The sum of the foregoing is this: from the week ending August 31st till November 9th inclusive, we have to deal with sixteen cases of small-

pox, in eight of which no history of antecedent infection is known, and in eight of which previous communication with antecedent infection is proved. In the former eight are included (1) the case of the Purfleet signalman, (2) the first case (Sept. 21st) in Paper Mill Cottages, (3) the man in Dell Cottages, West Purfleet (Oct. 6th), (4) the case of the man (Sept. 15th) in West Thurrock, and (5) the other four cases in Paper Mill Cottages, notified on Oct. 28th, 29th, 30th, and Nov. 9th. Of the five cases in the Paper Mill Cottages, there must be considered in reference thereto the "missed" case of Mrs. C. and her child's "chicken-pox." It appears to me to be impossible to positively affirm, one way or the other, whether these five persons had, or did not have, any relationship, accidental or otherwise, with Mrs. C. or her child, seeing that they all lived within close distance of one another as a small community. It is not unreasonable to venture the opinion that chances of relationship were not unlikely, although no details one way or the other are given in Buchanan's report. The weight of the one opinion or of the other, under the circumstances, would be about equal. If these cases could be eliminated on the ground of known relationship with the cases of this woman and her child, there would only remain the case of the signalman and the West Thurrock case as instances of unknown antecedent infection. But even counting the Paper Mill Cottage cases, there are only eight cases upon which to bas in this epidemic at its commencement the possibility of aerial influence of the hospital ships.

The other important point which emerges is that, by the beginning of November, we have four or more different foci of infection in different parts of the Orsett Union for the spread of small-pox. After that date, and taking into consideration the fact that small-pox is mistaken early in the epidemic for chicken-pox, and that infected persons are found at their work, it does not appear to me necessary to account further for the progress of the epidemic in a susceptible population, except to add that persons proceeded daily from peripheral parts of the Union into infected centres, to and from their work, and who at the time had small-pox on their bodies. In short, we have eight cases at the very most, and even then some, of whose infection reasonable explanation may be made without recourse to any aerial influence, as the indication in the population of the Orsett Union at the beginning of the epidemic, of the aerial spread of infection from the hospital ships. In any case, when the details of the spread of the epidemic are considered, it is quite clear that traffic to and from other parts of the Union must be looked upon as largely to blame for the extent of range and persistence of the epidemic. Purfleet is not like

many other places of similar size and population, self-contained: on the other hand, it is the centre to which are attracted for daily work many persons from more sparsely-populated parts of the Orsett Union. Considerable intercourse took place also between Purfleet and Grays. Several persons belonging to Grays worked in the Purfleet works; for example, five out of the twenty-five cases notified in December were employed in one or other of the Purfleet works, four of the January cases, and single cases in each of the months of March and April. Persons from Grays visiting Purfleet were known to have been passive carriers of small-pox to persons in their own town. The same generally was true of West Thurrock. Six or seven persons employed in Purfleet from that village were attacked by the disease. In South Ockendon, too, the same general observation holds good. Between the middle of October and the end of January, no cases were known in that village, but about the latter time an outbreak involving twenty-seven persons took place, the first case of the series being a man who worked in Purfleet. In Averley, a case was notified as early as November 9th, of a man who worked in Purfleet. But the outbreak of twenty-two cases in fourteen houses in that place between December 10th and the beginning of February, was ascertained to be chiefly, if not entirely, due to undetected small-pox in a family in the place, in which a mother and a child suffering from mild small-pox did not have medical advice, and remained at home for two weeks or more before the exact nature of their illness was discovered.

In view, therefore, of the very limited number of cases involved, eight at the outside, at the commencement of the epidemic, of the doubtful source of infection of five or some of these, of the generally easterly and northerly wind movement during the first half of September, of the incidence of the cases at the outset, and of the susceptible condition of the infantile population and adult population, it does not appear to me to be well established that aerial influence need be invoked to account for the outbreak or its continuance in the Orsett Union.

Immunity of Garrison and Training Ship.—Little need be said respecting the immunity to small-pox exhibited by these communities. No small-pox occurred among them. They were protected populations, owing to the practice of re-vaccination. At the time of the outbreak some of the garrison had not been re-vaccinated, but in the interval of performing that operation they were prevented from entering infected neighbourhoods. Two cases of small-pox occurred, however, in the neighbourhood of the barracks.

Before, in any given epidemic, the conclusion is arrived at that aerial

convection or dissemination from a small-pox hospital has been any factor, or an important factor in the origin and spread of the disease in a neighbouring population, there are certain circumstances which are bound to have the most careful consideration. One of the first of these is: whether the inmates of any institution contiguous to the small-pox hospital have suffered from the disease in a measure corresponding to that found in the general outside population.

Fortunately, this question may be answered now from a variety of experiences which have occurred during different epidemics in different places. In answering it, however, due enquiry must be made respecting the protected or unprotected condition of the inmates of the particular institution in question by reason of former small-pox attack, or by vaccination and re-vaccination, since, obviously, this is bound to have the most important bearing upon the results likely to be found, and upon the conclusions deduced therefrom. To some extent, also, must the age-incidence of the inmates be considered, because owing to the relatively much diminished susceptibility of those aged fifty and upwards to attack, even without protection by vaccination, the attack-rates of different institutions are likely to vary in amount.

It has been shown that the hospital provision and means of isolation adopted in Germany have been entirely determined by the protected condition of its population by compulsory vaccination and re-vaccination. In our own country, moreover, occasional examples of like protected communities are met with in institutional populations. The history and experience, for example, of the Purfleet garrison, and of the inhabitants of the training ship, during the Orsett Union epidemic, illustrate on a small scale what the German experience does on the large scale.

Keeping, therefore, these points in view, our observations may be centred in the answers which the circumstances of institutional populations situated relatively near small-pox hospitals permit us to give. The two relevant questions, therefore, in this connection appear to me to be these: (1) Whether a relatively like attack-rate or relative immunity to attack has been found to prevail in institutional populations in different epidemics; and (2) What evidence is thus afforded, one way or the other, in favour of or against the view of aerial convection or dissemination.

The following is pertinent to the consideration of the first query. The comparatively small attack-rate found in the workhouse populations in the Sheffield and Ecclesall Bierlow Unions during the Sheffield outbreak, and of the workhouse and brewery populations during that of Warrington, show at least that in some instances small populations may

exist alongside concentrated acute small-pox without incidence of infection other than that due to direct or mediate sources. In these instances, certainly, where presumptive risks of aerial transmission of the disease would be present if aerial convection prevailed, no such evidence was forthcoming after inquiry. In the Sheffield unions, where small-pox cases were being treated in relatively large numbers in pavilions within the workhouse curtilages, and in the Warrington epidemic, where the workhouse was only separated from the small-pox hospital grounds by a wall, there was no evidence discoverable by Dr. Barry in the former, or by Dr. Savill in the latter, that aerial transmission had anything to do with the causation of the cases which did occur within these contiguous buildings. Dr. Barry, indeed, declared that direct and mediate sources of infection from the hospital accounted for all the cases in the Sheffield institutions, and Dr. Savill was able to track the direct or mediate sources in the cases which developed within the Warrington institutions.

The Commission on Small-pox Hospitals, moreover, had not a little evidence presented to it by different witnesses with regard to the relative immunity of like institutional populations elsewhere. Dr. Dudfield, for example, in his evidence stated that Homerton Hospital, which is situated from ninety to a hundred feet from the City of London Infirmary, did not appear to have had at any time any inimical influence in this direction, and that no cases of small-pox had occurred in the latter institution from the treatment of acute small-pox cases in the former. The Commissioners themselves seem to have been struck by this fact, as is shown in the following passage, which I quote from their report. Referring to the above case, they said that "the workhouse had scarcely any cases in the epidemics of 1871—77, when the disease was extremely prevalent in the surrounding streets, although at that time the inmates were not protected by re-vaccination. The same may be said of the Hackney Union Workhouse and Infirmary, which are about a quarter of a mile from the Homerton Small-pox Hospital."

In the Fulham District, there were four similar institutions within half a mile of Fulham Hospital, but curiously enough, Power says nothing regarding their fate in his report. From the evidence laid before the above Commission, we are able to appraise the extent of attack on the inmates of the City of London Infirmary, and to compare it with the extent of attack on the inhabitants in the adjoining streets. We learn that during the eleven years ending 1881, 17 cases of small-pox had occurred in its wards. Of these, Dr. Aveling stated in evidence, that 12, and possibly 15, had contracted the disease within the institution. But even the largest of the figures given, in view of the fact that the inmates

numbered 450, does not betoken aerial transmission of the disease. Further analysis of the 17 cases shows that the incidence in number of cases in each year during the eleven years was not unlikely determined by the policy of the hospital with regard to the practice of re-vaccination. It would appear that between 1871–76 re-vaccination was not carried out systematically on the inmates, that in 1876 it was commenced, and that between 1877 and 1881, both inclusive, it was systematically practised. It is not surprising, therefore, to find that 13 of the 17 cases occurred during the first period, and the remaining 4 cases during the latter period. The evidence also shows that during the ten years, 1871–80, the attack-rate in the streets around the hospital within the $\frac{1}{4}$-mile radius varied from 4 to 25 per cent., the average being 9 per cent., whereas in the workhouse it was less than 4 per cent., calculated over the ten years. These figures illustrate in some measure the effect of no special provision of re-vaccination and of its systematised operation upon the incidence of the attack-rate within one institution. Again, the case of Hackney Workhouse and Infirmary is instructive. It was about a quarter of a mile from Homerton Hospital. During the eleven years, 1870–81, it had an average yearly population of 643 persons, the number of small-pox cases which occurred within it being 20. Here it was the habit to vaccinate early all infants born in the building, and to re-vaccinate such of the other inmates as chose to have it done.

In this connection, the cases mentioned in Thorne's Report must also be noted. These were relative to the small-pox hospitals of Leeds and Nottingham. In the Leeds case, the hospital contained 118 small-pox patients, and was situated from 36 to 200 feet only from neighbouring dwelling-houses. Although the authorities would have been pleased to get evidence of harm from the hospital to the houses, none could be shown on inquiry. In Nottingham, the small-pox patients occupied a new wing of the workhouse buildings which had been built immediately continuous with these buildings, and which was bounded on one side by a narrow street. Although the windows of the small-pox wards in this case were only 44 feet from the houses in the street, no evidence was obtainable to the effect that small-pox had been spread to the neighbouring houses. During the Glasgow epidemic of 1900–02, in an institution immediately contiguous to the curtilage of the small-pox hospital, one case only of small-pox occurred, even although for most of the time the small-pox hospital was crowded. Even in this case it was not possible to exclude the possibility of in-brought infection from outside. So far as I am aware, this is the only occasion during the different epidemics in Glasgow, during which the present small-pox hospital has been in use for the treatment of

cases, in which any small-pox appeared in the institution in question, notwithstanding the fact that the hospital was on all these occasions always more or less full of patients.

It may be said, therefore, that experience regarding institutional populations in the near neighbourhood of small-pox hospitals demonstrates that they have enjoyed lower attack-rates than general outside populations, and to an extent wholly inconsistent with the view that aerial transmission or dissemination from the hospital of the contagium prevailed. Moreover, it must further be said, especially of the Sheffield, Warrington, and other epidemics, that when small-pox cases did arise in such institutions, the source of infection by direct and mediate means could be traced.

Many interesting speculations arise in the discussion of the reasons for such relative immunity. It may be said that in respect that the inhabitants of such places have fewer opportunities of public sources of infection by reason of their confinement within the institutions, it naturally follows that a lower attack-rate ought to be anticipated. To this must be added the effect of age incidence of the inmates. Whether or not these reasons are sufficient to account for the relative immunity which they have been proved to enjoy at times when around the institutions the disease prevailed extensively, is an open question, but doubtless they operate to some extent.

The only answer which can be given to the second query before propounded, in the light of the evidence, is that the experiences of different institutions in different places during different epidemics is distinctly against the theory of aerial transmission; indeed, from the very fact that in the cases given, which form all those within recent epidemics whereby the doctrine of aerial convection might be tested, direct or mediate sources of infection were traceable, forms a body of strong positive evidence that aerial dissemination from the small-pox centres did not at all operate. Further, in view of the fact that these institutions with respect to vaccination and revaccination were reasonably comparable with the general outside populations, and yet had a relatively lower attack-rate, affords still stronger proof of the absence of aerial transmission. What proof must be considered as reasonably sufficient to prove the operation of aerial transmission or dissemination as the cause of origin or spread, or both, of any given epidemic from any given small-pox hospital? This question would deserve comparatively little attention if it were merely a subject of academic discussion. But it is much more than this: its consequences are very important and far-reaching. If aerial convection be a fact, obviously it must have a serious bearing upon the position which small-pox hospitals ought to occupy relative to contiguous populations. McVail (Brit. Med. Jour., Vol. II., 1902, p. 32) puts the matter so

pithily that I quote what he says: "Every epidemic of small-pox shows more and more clearly the dangers attached to such hospitals. Where they are in use on any large scale near any considerable population, they are very likely, if not quite certain, to have the effect of spreading small-pox in the surrounding neighbourhood. The facts give very strong evidence that the spread is both aerial and by contact, and indeed, it seems to defy every preventive measure. If these conclusions are sound, they raise some very serious questions. Where are sufficiently isolated sites for small-pox hospitals to be found? What right has a city community to determine that the residents in any particular locality within its bounds, or in the country near it, shall be exposed to the risk?" The Commission on Small-pox Hospitals have had their views reflected in the regulations laid down by the English Local Government Board for the sites of new small-pox hospitals, and these regulations, moreover, to some extent, also carry belief in the aerial theory of dissemination, as laid down in Power's Report, to certain defined distances from a hospital, depending upon the existence of institutions and numbers of populations within these distances. But what shall be said of the views of later writers, who aver that the influence of a small-pox hospital may be transmitted, and may operate at a distance of three miles therefrom? It is only reasonable to expect that before such an opinion is deliberately promulgated there should be the clearest unequivocal evidence of the existence of aerial transmission and operation, because of the momentous issues which are thereby involved.

This brings me then to the kind and character of the evidence which ought to be deemed as relevant to prove the existence and operation of aerial influence.

Savill, in his report of the Warrington epidemic, has given some attention to this subject. He lays down the following four conditions which, in his opinion, are necessary in any given instance to prove aerial convection, viz.:— (1) That the immediate and mediate methods of infection are neither of them in operation in any given case or cases which form the basis of observation: (2) That the proportion of infected houses or persons (whose infection is not accounted for by mediate or direct means) varies with the distance from the supposed centre: (3) That the proportion of infected houses (where the infection is unaccounted for by direct or mediate means) in a given district round the supposed centre varies with the direction and the strength of the winds: and (4) That the proportion of persons so attacked varies with the number of cases collected in the supposed centre, and as some say, with the stage of the disease which the cases have reached: in other words, the period of a "rising epidemic."

In discussing these conditions, it is necessary to ask whether or not it is possible to realise them in any given epidemic. With regard to the first, all that needs be said is, that the usual reason in recent epidemics for invoking the aerial theory is that in a certain number of cases of small-pox, within a certain distance of the small-pox centre, no direct or mediate source of infection is discoverable. In the Fulham epidemic, for example, there were within the special area twenty-three such cases, and in the Orsett Union epidemic at the outset six such cases. To account for such, therefore, it seemed necessary to invoke some source out of the usual course, and it was believed only aerial dissemination from the small-pox hospital fitted the facts. But the question must be fairly put and answered: in any epidemic of small-pox is it always possible, for a variety of reasons, to track the source of infection of all cases, even indeed of those which occur in areas considerably beyond the supposed range of aerial influence? I fear that the only answer which can be offered will be in the negative. Much of the information regarding sources of infection of groups of cases is often obtained *post facto*, and sometimes long after they have done all the mischief they could in spreading the diseases: and there can be no doubt that some mild cases during the currency of an epidemic go undetected from first to last. Owing, in short, to the existence of undetected, mild, ambulant cases of small-pox, or of so-called, non-medically treated cases of "chicken-pox," in the pre-epidemic stage of an outbreak, susceptible persons are infected from these under circumstances to them unknown, and consequently they are unable to account for the origin of their attack. Such conditions, indeed, prevail during the whole currency of an epidemic, but there is a better chance of their detection when the public mind is on the alert, while the epidemic is actively in progress, than at the commencement when the outbreak is not anticipated. Ample illustrations of this are found in all epidemics. Here then, at the very outset, are we met with an insuperable difficulty, that is, to say whether or not any given case or cases have been infected directly or indirectly; in other words, it cannot be averred of any given case or cases that direct or indirect infection did not take place merely because the source of the infection cannot be traced, even pre-supposing the very highest detective attributes in the inquirer.

Savill's second proposition, however, provides that another test should be applied to such cases. Does the proportion of infected houses or persons vary with the distance from the supposed centre? It will be noted that the statistical test here proposed differs radically from that at present adopted. The method adopted by Power, and followed by most observers since, to demonstrate the aerial influence of a small-pox hospital, is to con-

struct rings or circles within varying distances of the hospital as a centre, and to calculate per 1,000 persons populating said circles, or per 100 or per 1,000 houses within these areas, the ratios of persons attacked or houses invaded by the disease. It will be observed that all the cases attacked or houses invaded are slumped together, irrespective of whether they have been infected directly or indirectly, and the gross number is calculated into the numbers of population or houses respectively. Let it be borne in mind that this mode of computation is intended to indicate, not simply the incidence of the disease in these different areas, but the transmission aerially of the disease from the hospital. It goes without saying that this mode of computation involves grave fallacies. Starting out to discover small-pox incidence from aerial influence from a small-pox centre, the method includes *all* infected cases, no matter whether imported or not, and no matter whether directly or indirectly infected, to prove that this incidence is due to aerial transmission; in other words, the unaccounted-for cases, upon which the aerial theory is founded, and the accounted-for cases are added together to show that the influence which has determined the origin of the former class must proceed from the hospital. It is not beyond the bounds of possibility to find infection introduced into a district not far from a small-pox hospital, and to see the disease spread in that district. That, in fact, was the history of the outbreak in Glasgow in 1900—02. When the incidence of attack-rate in different zones comes to be calculated, one could expect nothing else than to find exceptional prevalence of the disease in the zones nearest to the hospital, and greater in amount than in zones further removed. Reckoned on the methods now used, such figures would be held to be proof of aerial influence from the hospital, whereas they do nothing more than indicate the locality of origin and spread of the outbreak. It is difficult in a few lines to show how the present statistical expression of incidence of small-pox may lead to grave fallacy without full regard being paid to the intimate facts of the beginning and course of the epidemic; it is enough to say that in any attempt to prove aerial convection from a hospital, it is statistically improper to include those cases whose direct and indirect sources of infection have been found with those whose source of infection is not discoverable. It is necessary to note that I am not now discussing the question of the general influence of a small-pox hospital, but hospital aerial influence as a separate entity or factor in the spread of the disease in neighbouring populations. It seems to me to be clearly established that hospitals placed in close proximity to such populations are calculated to spread small-pox by direct and mediate means; but my contention is that evidence to prove aerial convection therefrom is not forthcoming. The continuous traffic of infected persons and things to the

hospital, the possible "leakages" therefrom, and the other well-known possible means of communication of those within the infected area with those without, fully account for this inimical effect. But when the aerial theory is invoked, it is necessary to justify by evidence the opinion which is expressed. And in this direction, having eliminated by searching, patient, and persevering enquiry the possibility of direct or mediate infection (if that be humanly possible), it is only relevant to bring into the calculation such cases whose origin it is impossible to account for. Such a method of reckoning aerial hospital influence would at least be on right lines, however much, even then, it would be subject to criticism owing to the fallibility of human discovery.

Another mode of statistical expression to test aerial influence is by quadrants constructed from the hospital as a centre and worked into the same distances and on the same bases as in the circles. The chief object of this method seems to have been to test the doctrine of aerial influence by the incidence of the disease in the different quadrants in relation to the direction of the winds prevailing at the time. Power believed that three meteorological factors appeared to aid in the operation of aerial convection, viz.: (*a*) a still, foggy atmosphere; (*b*) low temperature; and (*c*) absence of ozone. Other observers think that the contagium is likely to be borne in the direction of the prevailing winds. From a consideration of the meteorological conditions found to prevail in different epidemics in which aerial influence was believed to exert its effect, it appears to me that the foregoing concurrent conditions are by no means uniformly present. In the Warrington epidemic, Savill noted by this system of quadrants that the incidence of the disease in the neighbourhoods of the hospitals was less severe in the very quadrants which ought to have been infected by wind-borne contagium from the hospitals; and in the Orsett Union epidemic, the meteorological tables appended to Buchanan's report show that for the first fourteen days of September—when the first cases occurred—the direction of the wind was not favourable for carrying the contagium from the hospital ships to Purfleet village. In the Leicester epidemic of 1892—93, relative to the supposed aerial influence of the hospital on the suburban district of Newfoundpool during the month of June, Dr. Priestley informs us (*The Lancet*, Aug. 6th, 1894) that the temperature varied from 45 to 70 degrees—generally, a high mean temperature—the barometric pressure was high, there were nineteen days with blue sky and nine days with cloudy skies, and the wind blew from the hospital to the houses invaded. Here, then, in different epidemics, we have such diverse conditions as still, foggy weather and blue skies, and keen frost and a high mean temperature, in which aerial convection

was supposed to prevail. Such facts as these merely go to show that no uniform concurrent meteorological conditions are found to prevail while aerial dissemination is believed to have been active. Assuming for the moment the truth of this doctrine of aerial convection, Savill's figures for the Warrington hospitals show that the incidence of the disease was not greatest in the path of the prevailing winds, and that with regard to one of the hospitals, the incidence was exactly the converse of what might have been expected.

It is not necessary to discuss in detail the fourth condition which is set down by Savill. Probably it is enough to say that the general consensus of opinion and accumulated proof tend in the direction of affirming the truth of the view that the contagia of air-borne infectious diseases generally gain intensity by accumulation or concentration of cases within hospital wards, and that that is true of small-pox, keeping its special features in view, like the others. Further, it may be said that quite apart from hospital influence, an outbreak of small-pox in any community can only occur by the introduction of pre-existing contagium, and can only spread by the susceptibility to attack of those who are exposed to it: hence the range of operation of any given outbreak of small-pox is determined by the immediate area into which the contagium is conveyed, and by the susceptibility of those who come within the sphere of its action. Were it always possible to isolate all who are attacked first, and all those who have been exposed to the contagium, all outbreaks would be stopped quickly, but it is entirely owing to the difficulties experienced in effecting this that the disease continues to spread. The susceptibility of a population to small-pox, therefore, during a rising epidemic means little more than that persons constituting part of that population offer a suitable soil for the organism.

The conclusion at which I have arrived from this critical study of small-pox epidemics with regard to the doctrine of aerial convection, is that the doctrine has not been proved, that in some of the epidemics the conclusion as to aerial evidence is blighted by the want of distinction between the hospital as a direct and indirect source of infection of those resident outside its walls, and that in others the doctrine has been suggested from the flimsiest evidence. To my mind, as indicative of proof against the doctrine, there are the different histories and experiences of institutional populations placed within the range of aerial influence, if it existed, which cumulatively compel me to say that no such aerial dissemination seemed to have existed.

CONGRESS AT GLASGOW.

SECTION II.—ENGINEERING AND ARCHITECTURE.

ADDRESS

By Prof. HENRY ROBINSON, M.Inst.C.E.
PRESIDENT OF THE SECTION.
(FELLOW.)

WHEN the Council of The Sanitary Institute invited me to preside over this Section, I felt, whilst appreciating the compliment paid me, that I should experience a difficulty in preparing my address, as the subjects which interest all who are engaged in advancing sanitary work in engineering and architecture cover so wide an area. I decided, therefore, to confine myself to reference to those with which I have had to deal in my own professional life, as they embrace matters of great interest and importance, and, at this time, justify special attention being given to them.

Those who have to advise in regard to works which affect the health of the community have a responsibility which should never be lost sight of. If their functions are faithfully and skilfully discharged, there will result an improvement in the hygienic conditions of our centres of population, with the consequent increase of health and happiness in many homes where, if these functions were not well performed, there would either be loss of life, or of that energy which makes existence useful and enjoyable.

In advising as to the expenditure of public money on sewage outfalls there is abundant data now to determine the right system for each place. I am quite confident from my experience that the conditions vary sufficiently to require intelligent and impartial consideration to be given as to which of the several systems, or combination of them, best meets each case, as it is too often the practice to apply an arrangement of works, or a system, to an outfall because it was applied successfully somewhere else, although the conditions differ materially.

The want of proper provision for dealing with storm water at outfalls is often a fruitful source of trouble. I have had to examine several sewage outfalls where the results were unsatisfactory, and I have found

that failure was mainly attributable to the fact that the discharge at the outfall, through defective construction of sewers or otherwise, of more than three times the normal dry weather flow, which the Local Government Board require to be dealt with as sewage, prevented whatever system of treatment was in operation from having a chance of success. If chemical precipitation was the system, the excessive amount of fluid caused much solid matter to be washed through the tanks which would have been deposited if the flow had been less irregular. If bacterial methods were in operation they were working at a disadvantage, as innumerable colonies of bacteria were being washed away in the beds, their ripeness being thereby destroyed. Waste land of a pervious character, or rough filter beds, if no land is available, should receive discharges due to abnormal rainfall, which should be carefully differentiated from the normal flow of sewage. This admits of fairly close determination, so that an arrangement of works can be designed which will give successful results.

When chemical precipitation was first adopted, the sludge resulting therefrom became a difficulty, as it caused a nuisance. The conversion of the sludge into cakes, by pressing, diminished the difficulty as regards nuisance, and the hope arose that the pressed cake would realize more than the cost of pressing and would prove a source of considerable profit.

Although experience proved this to be fallacious, chemical precipitation is frequently burthened with the cost of sludge-pressing apparatus. Where some land is available this can be avoided by employing chemical treatment to effect the deodorization of the sewage, and to the precipitation of the solids. These may be conveyed in a fluid and fairly inodorous state to the land, to be disposed of and utilized for agricultural purposes without nuisance if dug in promptly. An illustration of this is afforded at the Finchley outfall, where Professor Kenwood has carried out this plan.

In any arrangement of sewage disposal works, a sedimentation tank is now regarded as useful, in order to arrest the suspended inorganic matters in sewage which tend to clog any kind of bed. The great bulk of the inorganic matter is arrested in this tank, provided the rate of flow through it is properly regulated. Some organic matter is also deposited, which is converted into liquid and gas by anaërobic, septic, or cesspit action, the liquid passing away with the sewage. The neglect to adopt this simple preliminary treatment has caused most of the difficulties in regard to the silting up of bacteria beds. By having sedimentation tanks, or other means of arresting inorganic matters, and by using suitable material for the beds, permanent reduction in the capacity of the beds is avoided, or is but trifling.

It has been found that fluctuations in the purity of effluents from bacteria beds will occur when the quality and quantity of the fluid applied varies considerably, which is what might be expected. New bacteria beds require to be treated at the outset with small quantities of fluid, until they have become ripe, that is when the bacterial action has been well set up. By overtaxing a bed its efficiency is diminished, whilst by regulating the amount of sewage that is applied to it the best results can be obtained.

Years ago the Massachusetts State Board of Health conducted a long series of experiments for the treatment of sewage bacterially, by passing it through beds filled with gravel stones, which it was stated afforded the best illustration of what takes place in the purification of sewage, and it was found that "the slow movement of the liquid (even with the coarser suspended matters contained in the sewage) in thin films over the surface of the stones, in contact with air, caused 97 per cent. of the organic nitrogenous matter, a large part of which was in solution, as well as 99 per cent. of the bacteria, to be removed during a period of some months."

There is a great amount of information available as to the results obtained at sewage outfalls by various arrangements of bacteria beds and methods of working. In endeavouring to utilize this, one feels that in many cases there has been an adherence to some particular system instead of comparing different systems and arrangement of works under precisely the same conditions as to volume, composition of sewage, etc. The investigations of Mr. Alfred Creer at the York Outfall, of Mr. G. D. Watson at Birmingham, and of Mr. K. F. Campbell at Huddersfield, deserve especial mention as having been carried out without preconceived views or prejudices.

The arrangement and construction of bacteria beds admit of being determined so as to prevent the efficiency and success of the beds from being neutralised, as they often are, by non-compliance with what experience has pointed out as the essentials. If these conditions are complied with, and if the beds are properly worked, a very large portion of the oxidisable and putrescible organic matters in sewage will be removed, and if the effluent is treated in a second series of beds the highest standard of purity is obtainable. I have examined the cause of failure of beds in several places and have found clogging and inefficiency to be often due to the material containing fine particles which settle to the lower part and partially fill up the interstices. In other cases the beds were being worked without regard to the volume or composition of the fluid applied, both of which are factors in regard to the bacterial purification which is aimed at.

Experience has shown that with a given area of land a much larger

volume of foul fluid can be bacterially treated by the trickling or sprinkling system, than by the contact system. In either case the selection of suitable material for the beds is all important, and that which is used must be governed by the locality. The action of aërobic bacteria in the presence of air admits of ready explanation, and that of anaërobic in a cesspit has long been known. I have not yet had a satisfactory explanation of bacterial life in a bed which is alternately filled, emptied, and left empty, for the recognized eight hour cycles.

Twenty years ago I treated crude sewage at an outfall by upward filtration through tanks with false bottoms, over which was a layer of rough stones. The sewage passed slowly upwards through the stones, leaving the larger suspended solids in the false bottom, where they became liquefied by anaërobic action, and the liquid was pumped on to land, with excellent agricultural results. The filter was rested by stopping the flow of sewage at long intervals, when any organic matter that had been retained in the interstices of the stones became liquefied.

In the report to the London County Council by Prof. Clowes and Dr. Houston (issued this year) the results are given of experiments with crude sewage which has first passed through sedimentation tanks at the rate of a unit volume of sewage in six hours. The sewage passed through these tanks to coke filter beds. The following conclusions are given in the Report (page 33):—

"1. That by suitable continuous undisturbed sedimentation the raw sewage is deprived of matter which would choke the coke-beds, and the sludge which settles out is reduced in amount by bacterial action to a very considerable extent. This reduction might undoubtedly be increased by the preliminary removal of road detritus.

"2. That the coke-beds, after they have developed their full purifying power by use, have an average sewage capacity of about 30 per cent. of the whole space which has been filled with coke.

"3. That the sewage capacity of the coke-bed, when the bed is fed with settled sewage, fluctuates slightly, but undergoes no permanent reduction. The bed does not choke, and its purifying power undergoes steady improvement for some time.

"4. That the coke of suitable quality does not disintegrate during use.

"5. That the "bacterial effluent" of settled sewage from the coke-beds does not undergo offensive putrefaction at all, even in summer heat, and can never become offensive. That this effluent satisfactorily supports the respiration of fish.

"6. That the use of chemicals is quite unnecessary under any circumstances when the above method of treatment is adopted."

The admission of trade wastes to sewers in large quantities causes difficulty to arise in treating the sewage at the outfall, especially when the waste is not admitted at regular intervals coinciding with the varying volumes of sewage, and when undesirable solids are not removed. If the conditions as to the admission of the waste are observed there is no trouble in dealing with it, when it is associated with sewage in reasonable quantities, as the sewage sets up the necessary putrefactive change if the waste is either acid or alkaline, unless in excess, when it should be neutralised before admission to the sewer. In my own practice I have had experience of this, and do not think that there exists any insuperable difficulty in arranging for manufacturers to utilise a sewerage system (when proper safeguards are adopted), as they can fairly claim to do, considering that they contribute to the rates of the town in which their trades are carried on.

In considering the question of pollution, chemical analyses admit at present of a better means of arriving at comparisons than bacterial analyses, as the deductions that can be drawn from the latter are, as yet, a source of controversy.

In determining what standard of purity of effluent should be required, the circumstances of each case will have to be dealt with. Perhaps some minimum standard might be fixed, but there should be no question as to the necessity for carrying out remedial works to prevent crude sewage being discharged into estuaries and rivers to cause nuisance. The nature and extent of the works must be governed by the conditions of the place; as an effluent might be permitted at one outfall which is not chemically or bacterially pure, but where the bulk of the polluting matters having been arrested, the few that remain can be safely left to the purifying influence of the sea, estuary, or river into which it passes.

The requirements of the Public Health Act with reference to the purification of foul fluids before their discharge into rivers, etc., has not been considered as applying to tidal waters, and the Rivers Pollution Act has only very rarely been put in force. Inasmuch as it is illegal under the common law to pollute the air, or the rainfall after it reaches the earth, it is equally illegal to cause a nuisance by polluting the tidal water of an estuary, or the foreshores adjoining, as the Courts have held in cases with which I am familiar.

However skilfully outfall works may be designed and carried out, after all the results depend on efficient management. Some supervision by an official "Inspector of Outfalls" would be an advantage, as it often

happens that an outfall is mismanaged or neglected, with the attendant injury to private interests by nuisance, which involves litigation.

The question of the better conservation of the rainfall of this country is one of national concern, and yet it has not received the attention that it requires on the part of the Government.

Providing water for the communities in a watershed, and removing the fluid refuse from their midst, are so intimately associated that it has often been urged, and properly so, that the country should be divided into drainage areas, forming natural (and not artificial) boundaries coterminous with sanitary districts, so that the needs of the entire population, both urban and rural, within each area should be equitably dealt with. What is imperatively required is an Authority having control over the whole of a watershed area, and responsible to a Department of State. The Royal Commission on Sewage has indicated the desirability of forming River Boards, and the President of the Local Government Board has raised the hope that he will bring before Parliament a Public Health Bill, which would presumably deal with these matters on the lines that have for so long been laid down. I think a Royal Commission would facilitate matters by bringing into definite shape the lines which legislation shall follow.

The past history of our watersheds indicates that they have often been monopolised for the supply of towns whose requirements can only utilise a fractional part of what the watershed is capable of yielding. Many centres of population in rural districts are without any proper water supply, and many are dependent on a well or wells (often far from pure) which fail during periods of draught. I know of many such cases throughout the country, and the requirements of these small communities should not be disregarded as they now are.

We have an object-lesson in the exceptional rainfall of last year. The utilization of the excess water in wet seasons to meet the deficiencies in dry seasons can only be accomplished by the construction of impounding reservoirs in which flood waters would be stored with the double advantages of mitigating the disastrous effects of floods and of better adjusting the balance between supply and demand. In this connection much could be done to utilize the power due to the flow of water from a high to a lower level to which I have devoted much attention, but it is beyond the scope of this address to deal with it.

In considering the question of conserving flood water for town supply, it must be remembered that until quite recently the storage of flood water was objected to, as it was under the ban of being polluted. This leads me to refer to what has removed this ban.

Lord Balfour's Commission on London water had before them a scheme prepared by me for the Water Companies by which at small cost comparatively an impounding reservoir could be constructed in natural valleys of the Thames for the future supply of London. The report of this Commission issued in 1893 was adverse to this, and characterized the storage of flood water as "highly objectionable and undesirable." The report of Lord Llandaff's Commission in 1899 removed the ban, as it stated that "no restriction need be placed on taking flood waters," and also, "it would present a double advantage—the cost of pumping to store would be saved, and it would be possible to take much more water into the reservoir when the river is full as the intake would not be limited by the capacity of the pumps, which cannot deal with more than a fraction of the water passing down at times of flood."

The late Sir Edward Frankland, in a paper at the Royal Institution of Great Britain in 1896, said that "the bacterial improvement of river water by storage for even a few days is beyond all expectations." The better conservation of the rainfall would enable that which is now wasted to be utilized in many parts of the country for irrigation purposes. The present unsatisfactory condition of the landed interests has led to many suggestions with a view to the better cultivation of the land. The establishment of new centres of population by the removal of industries from congested towns to parts of the country where land was going, or had gone, out of cultivation, involved the question of water supply, both for the people thus located and as affording means of cultivating the land surrounding the settlements.

Those who are dependent on underground water for their supply, suffer by the pumping operations of water or mining companies. Although the Courts have held that there is no title to underground water, it must be remembered that this ruling is based on the legal view that water cannot be "identified." In some cases this identification is possible by the employment of lithia, which can be traced, by spectroscopic analysis, considerable distances, as I have had the opportunity of illustrating in a case.

The exceptional rainfall in 1903, and its occurring during the usually hot, dry, and dusty periods, as well as in the usual wet periods, had one good result in preventing the floating dust from being blown about from filthy road surfaces. The effect of this, together with the cleansing of the drains, sewers, and surroundings of houses, was the reduction of the death-rate, that year being one of the healthiest on record, with a death-rate nearly 3 per 1,000 below the average for the previous five years. The adoption of wood-paving and asphalte in our main thoroughfares, although

attended with the advantage of being less noisy (especially as regards asphalte) than the usual macadam road, requires systematic cleansing with hose and water, and good scavenging, especially during warm, dry weather. This is at present very imperfectly done, where it is even attempted, the result being that the air is charged with foul dust from the polluted road surfaces, causing injury to health. The cost of effectively cleansing the main roads of our towns deters local authorities from doing it, but those who regard the matter only as affecting the rates should recognise that the improvement in regard to health, and the increased power of the community to do work, and better work, should be regarded as having a money value.

As bearing upon road sanitation, the present method of preparing the surface of our main roads leaves much to be desired. The employment of asphalte and wood has led to a beneficial reduction in the noise caused by vehicular traffic, but the constant patching of the very uneven surfaces is serious. I am hopeful that in the near future our main roads will be covered in such a way as to be smooth, durable, and as noiseless as any existing arrangement, and I have under observation forms of construction which warrant my entertaining this view. A road thus made would offer a smooth surface for vehicles of all kinds, and when motor traction supersedes to a great extent horse traction, as it no doubt will do, there will result a reduction in wear and tear and noise, together with the all-important diminution of filth and smells.

CONGRESS AT GLASGOW.

SECTION III.—CHEMISTRY, PHYSICS, AND BIOLOGY.

ADDRESS

By Prof. FRANK CLOWES, D.Sc., F.I.C., F.C.S.

PRESIDENT OF THE SECTION.

THE subjects which are brought together under this Section are naturally associated. Chemistry, Physics, and Biology, not only constitute an ample field, but provide a conjoint area, the dividing boundaries of which are indefinite or non-existent, and over which each of us must more or less frequently have cause to travel.

It is commonly considered that there is no very satisfactory delimitation of the field of the chemistry as compared with that of the physics, and it is certain that the biologist must concern himself largely with matters both chemical and physical. In respect of sanitary processes, it is indeed constantly found that one and the same purpose may be accomplished by chemical, physical, or biological methods.

Sewage treatment.—Perhaps no better instance of the alliance of these sciences can be given than in their application to the methods of sewage disposal, the discussion of which will constitute an important part of the business of this Congress. At one time the treatment of sewage by chemical processes was almost universally recommended, and discussion mainly turned on what chemical substances were the most efficient in rendering sewage inoffensive; then electrolytic treatment appeared upon the scene; and at the present time the discussion mainly turns upon the various means of applying biological treatment. The resolving action of organisms, which are excessively minute and are ranged at the bottom of the scale, appears to be likely to supplant the attempted purification of sewage by chemical precipitation and the more costly process of electrolysis.

It appears now to be generally conceded that some method of controlled biological treatment will be the generally accepted means of rendering sewage inoffensive, and of providing for its disposal; and it is probably because I have endeavoured to assist in the promotion of this desirable end that The Sanitary Institute has done me the honour of inviting me to preside over the meetings of this Section of their Congress.

When the London County Council decided that I should act as their chemical adviser the experimental treatment of London sewage had already been commenced by my predecessor, Mr. Dibdin, and it appeared very desirable that the experiment should be continued and followed up to a successful issue.

The sewage effluent which results from the chemical sedimentation of London sewage contains much organic matter, which rapidly passes into a foul and putrescent condition during hot summer weather; and its discharge into the lower river has occasionally produced an undesirable condition of the stream in times of heat and drought. The constant flow of upland water in ordinary times is found to prevent any large section of the lower river water from becoming offensive, and the tidal action perhaps assists in mixing the effluent with well aërated water, but the incompletely purified sewage effluent has at times produced unpleasant results in the river. This knowledge was sufficient to lead the County Council to sanction further expenditure on experimental work in connection with the modern biological method of treatment.

Bacterial Treatment by Intermittent Contact.—While the Council's experimental treatment was proceeding, Dr. Fowler was carrying out experimental treatment of a similar character upon the Manchester sewage. In the case of Manchester the rapid development of the treatment on the large scale became imperative, because the effluent was discharged into a stagnant canal instead of passing into a flowing and tidal river as it did in London. It is satisfactory to be able to report that, as far as the experimental bacterial treatment of the sewage is concerned, Dr. Fowler's results and conclusions agreed in every detail with my own, and when the high scientific attainments and practical common sense of Dr. Fowler are generally appreciated, as they must already be by those who know him best, this agreement augurs well for the future of the processes which have received his support and adoption. Owing to the necessity of pushing the treatment of sewage at Manchester rapidly from the experimental to the large scale, the Manchester treatment is at the present moment of extraordinary interest, as one is able to see in the Manchester sewage

works a successful, economical, and well-established bacterial treatment of the whole of the sewage of a large city proceeding in a satisfactory manner.

The process successfully adopted for Manchester, and which in the interests of Londoners one must hope to see soon adopted for the metropolis, consists in freeing the sewage from its heavy grit and coarser matter, and then allowing it to undergo sedimentation in large tanks through which it passes very slowly. The sediment in these tanks is mainly of an organic nature, and if left undisturbed a large part of it disappears by resolution into liquids and gases under the action of bacterial organisms contained in the sewage itself. The effluent from these tanks, after being freed from some dissolved gases by falling over a weir, is passed into coke-beds, which remain filled for several hours alternately with effluent and with air. Here further and special bacterial action frees the effluent from its easily changeable and putrescible organic matter, and enables it to be delivered into a water course in such a condition that it causes no offence and does not even lead to reduction in the aëration of the water. It accordingly leads to no nuisance and does not prevent the respiration of fish. The Congress will shortly hear from Dr. Fowler an important communication on his recent experience of this treatment.

Special bacterial estimations have shown that the treatment described above produces a very appreciable reduction in the number of bacteria present in the sewage.

The following extract from a paper communicated by me last April to the Society of Chemical Industry, states the nature of these experiments and gives the results obtained:—

> "Two classes of sewage in different localities were placed under careful observation, the cultures for counting the colonies which developed being put down at the time and place of collection of each sample.
>
> "One sewage was of purely domestic origin, being that derived from the residents in Christ's Hospital, Horsham. The sewage flowed into a settling tank, its passage through which occupied about 24 hours. The effluent passed through coke-beds contained in shallow tanks which were alternately allowed to stand full of effluent and full of air. The bacterial action taking place in the settling tank disposed of all the settled suspended solid matters, and the subsequent bacterial action in the coke-beds removed all putrescible dissolved matters.
>
> "The other sewage which was placed under observation was the average sewage delivered to the Northern Sewage Outfall Works from the sewers of North London. This sewage had been roughly screened, then mixed with small proportions of chemicals in order to expedite the subsequent sedimentation during its slow passage through settling channels, and the effluent from these channels constituted the feed to an intermittently worked coke-bed which was similar to that at Horsham. The feed to this bed, and the effluent from it, were subjected to systematic bacterial examination.

"It should be stated that the lower part of the coke-bed at the Northern Outfall consists of somewhat fine and compacted material, which may to some extent mechanically reduce the number of bacteria. It should also be explained that the screened London sewage contains only finely comminuted faecal matter, because it has been subjected to the process of pumping and a flow of many miles. The Horsham sewage, however, contains comparatively unbroken faeces, since it has flowed by gravitation only for a short distance. This would probably tend to diminish the number of bacteria found in the Horsham sewage, since the sample was collected by dipping the liquid from a collecting chamber outside the settling tank. Both sewages were clarified by passage through a filter-paper before they were subjected to cultivation.

"It is necessary to calculate the decrease in bacteria from the average results, since the samples of effluent obtained on the same day cannot altogether correspond to that day's discharge of untreated sewage.

"It may be noted that the results obtained from each of these samples when put down at once for cultivation were compared with the results obtained by putting down the same sample 21 hours after its collection. The average percentage increases in the number of bacteria counted, after keeping the samples 21 hours before cultivation, were 106 in the case of the sewage, 60 in the effluent from the tank, and 54 in the effluent from the coke-bed. As might have been anticipated, the highest rate of increase occurred in the most largely polluted liquid, and this indicates the necessity of not delaying cultivation of impure liquids which are under bacterial examination. It was found that a delay of 21 hours not unusually occurs between the collection of a sample and its arrival at and cultivation in the laboratory. This delay evidently leads to results which, in certain cases at least, do not correspond with those which would be yielded by the sample at the time of its collection, and in series of samples, such as those taken above, the delay very seriously affects the ratio between the numbers of bacteria found in the different series.

"In the case of the London sewage, samples were taken every ten minutes during the filling and emptying of the coke-bed, and the samples of sewage taken on each day were mixed to form the average sample for examination for that day, the average sample of effluent being obtained in a similar way. The average numbers at the foot of Tables I. and II. furnish a fairer means of judging the extent of reduction in the number of bacteria than the daily numbers do, since the effluent and feed of the bed on the same day are not precisely corresponding liquids.

"It will be seen that in the case of both sewages a marked reduction in their bacterial content takes place. As far as the effluent from bacteria beds is concerned, it appears, therefore, to be not proved that the bed is a means of increasing the number of bacteria; the bacteria rather appear to carry out their active functions in the bed, and to pass away in large numbers in the effluent in a lifeless condition.

"The results obtained are summarised in the following Tables I. & II.:—

TABLE I.—*Average Samples from the Barking Coke-bed.*

Date, 1903.	Total Number of Bacteria per c.c.	
	Settled Sewage.	Coke-bed Effluent.
May 9th	8,000,000	70,000
„ 13th	11,500,000	814,000
„ 14th	5,300,000	829,000
„ 16th	10,000,000	1,180,000
„ 19th	10,800,000	Lost.
„ 20th	6,600,000	1,070,000
„ 27th	7,900,000	1,675,000
Average number	8,585,714	939,667
Percentage reduction in the number of bacteria		89

TABLE II.—*Average Horsham Samples taken quarter-hourly during maximum flow of Sewage.*

Date of Collection, 1903.	Total number of Bacteria per c. c. (average of Cultivations).		
	Crude Sewage.	Effluent from Settling Tank.	Effluent from Coke-beds.
June 9th	7,300,000	13,650,000	8,750,000
„ 12th	9,800,000	10,850,000	9,500,000
„ 16th	9,000,000	5,750,000	6,650,000
„ 19th	8,750,000	9,800,000	8,050,000
„ 23rd	12,700,000	8,200,000	5,100,000
July 8th	16,450,000	3,650,000	3,000,000
„ 14th	23,450,000	21,700,000	18,200,000
Average numbers	12,492,857	10,514,285	8,464,285
Percentage decrease in numbers	...	15·8	32·2

The bacterial examination of the water of the Lower Thames was made in a manner similar to that described above, and has shown that the bacteria introduced into the river in the sewage effluent become progressively reduced in number as the effluent passes down stream. It has also been shown that the disappearance of certain of the organisms of intestinal origin was complete after a flow of some miles.

An extract from the paper in the Journal of the Society of Chemical Industry, which was referred to above, furnishes the following results :—

"*The total number of Bacteria in the Sewage Effluent* discharged at both outfalls is as follows:—

Date and Outfall.	Bacteria which grow at 20° C.	Bacteria which grow at 37° C. (Blood-heat.)	Aerobic Spores.	Number of Estimations.
Barking, March, 1903	8,585,714	5,100,000	234	Average of 7 Samples.
Crossness, June, 1903	6,300,000	.....	...	Average of 6 Samples.
Average	7,442,857	.....	.....	.....

"The average for both outfalls is therefore 7,442,857.

"*Reduction in number of Bacteria by passage down river.*—The samples were taken from the surface water by dipping, and were collected at low water in mid-stream and near either shore. The average of the results obtained from six series of samples collected on the 3rd, 4th, 5th, and 6th of March, 1903, are stated below:—

Locality.	Approximate Distance in Miles from the Crossness outfall.	Average Number of Bacteria per c.c.
Mucking light	21·3	4,837
Hole haven.....	24·3	3,431
Chapman light	27·0	1,662
Yantlet creek	29·5	711
Southend pier	31·5	379
Garrison point	33·5	381
Nore light	35·8	186
Below the Nore.....	39·3	145

"It will be seen that the average number of 7,442,857 bacteria per c.c., which were present in the sewage effluents discharged from the Barking and Crossness outfalls, have become reduced by the action of the river-water to 4,837 at a distance down-stream twenty-one miles from Crossness, and that off Southend, 31 miles from Crossness, a further reduction to 397 has taken place. When the Nore light-ship is reached, the bacteria number only 186 per c.c.

"Each water-sample was further examined for gas-forming bacteria, which are generally considered to be those of intestinal origin. Out of forty-five samples examined, only seven contained such bacteria, and these seven samples were all of them collected between the Mucking and the Chapman lights. No gas-forming bacteria were found in the water below the Chapman light. Hence it appears that the intestinal bacteria in the sewage effluent had disappeared from the river twenty-seven miles below the point at which they had been introduced into the stream."

Probably the introduction of these sewage bacteria into the Lower Thames and into the Manchester Ship Canal is of little importance. It might be well to insure their removal in other special cases, although it must be remembered that the vast majority of them are harmless, and are engaged in the beneficial work of further purifying the diluted effluent.

With regard to the sediment from the sewage, this has been found to disappear entirely when the sewage is of domestic origin, as it is for instance at Christ's Hospital, Horsham. In the case of a town's sewage, however, a portion of it will probably resist bacterial action and the residue will require to be occasionally removed.

Bacterial Treatment by Continuous Contact.—The method of applying bacterial treatment described above is generally termed treatment in the septic tank followed by intermittent contact in the coke-bed. It is well known that other methods of utilising the action of bacteria for the treatment of sewage are in vogue. In addition to the older treatment on land in the sewage farm, which is bacterial in nature, there is the much more modern continuous treatment in bacterial beds. The continuous method consists in spraying the effluent from sedimentation over a coke-bed which is freely open to air at its surface and sides. The mass of coke is accordingly never submerged, as in the intermittent method, but the liquid is continually dripping through the bed and the effluent is constantly passing away.

It is important that the fullest information should be furnished as to the relative advantages of the intermittent and the continuous methods of applying the final bacterial treatment: and it is to be hoped that one of the important results of this Congress may be the collection and dissemination of these useful data.

My personal experience leads me to favour, under the conditions of the London treatment, the adoption of intermittent contact. As compared with the continuous system, the intermittent appears to possess the advantage of passing the sewage more rapidly than some of the continuous methods, of requiring plant which costs less for its original installation and for its maintenance in good working order, and it appears to have the further advantage of furnishing an effluent which requires no final process of sedimentation after bacterial contact.

But there is little doubt that the statistics concerning continuous treatment are as yet by no means as complete as is desirable, and it is very possible that when fuller knowledge of the merits of the two processes

is available, it may be found that one or other method is preferable according to the varying conditions required for different localities.

It has been my good fortune as adviser to the London County Council to have had the opportunity of originating the bacterial treatment of sewage in several localities, and of watching the process in these and in other installations; while occasion has also arisen for inspecting most of the more important and typical sewage works in this country. I may state my conviction, founded now on many years' experience and observation, that this natural method of treating sewage is more rational and economical in practice than any other; that it is the only practicable means of dealing with the dissolved organic putrescible substances of the sewage; and that in dealing with ordinary domestic or town sewage, it has been invariably successful and devoid of offence wherever it has been properly installed and reasonably carried on.

It has already been stated that the bacterial treatment includes the treatment on land as well as the more modern controlled treatment in so-called contact beds. Unfortunately a sewage farm is only exceptionally possible for the treatment of town sewage; but, on the other hand, instances exist where suitable soil and ample area has been found and long runs of successful treatment of sewage on the land have been recorded. The more compact method of bacterially treating sewage in artificially prepared spaces is on the other hand everywhere applicable, and has the great advantage of being under easy control, of maintaining a constant and trustworthy action, and of furnishing a satisfactory and unvarying effluent.

Standards for Sewage Effluents.—It will be of great advantage to have at first hand from Dr. Dunbar, who has done classical work in connection with sewage treatment at Hamburg, an expression of his opinion respecting standards of purity for sewage effluents. Every one who has been interested in these matters will appreciate the great difficulty of laying down suitable limits to the organic and bacterial impurity of these effluents. Probably even the suggestion of the Rivers Pollution Commissioners, that an effluent should not be more impure than the water into which it is discharged, would not serve as a universal standard, although the suggestion might be found to furnish a generally useful standard in most cases.

Bacterial contamination of Shell Fish by Sewage.—It is also well that the special question of the infection of shell fish by the bacteria derived from sewage, should receive further public consideration. My own

independent examination of the Lower Thames and of the Thames estuary fully bears out the general conclusions on this matter which were arrived at by the Royal Commission on Sewage Disposal. A lengthened bacterial examination of the estuary in a large steamer fitted out solely for bacterial examination showed that the average condition of the estuarial water was practically in as satisfactory a condition bacterially as the water of the open German Ocean.

Quoting again from the paper referred to above, a statement is furnished of the bacterial examination of the water of the North Sea and of the Thames estuary, and the results obtained by these examinations are tabulated.

"*Number of Bacteria in the Water of the North Sea.*—A bacterial examination was made of the water of the North Sea by collecting samples of the surface water in the neighbourhood of the Galloper lightship, which is stationed about twenty-five miles seaward of the sea-end of the Barrow deep, and is therefore in the open sea.

"Samples of water were collected every five minutes for two hours, and equal volumes of the samples taken during each half hour were mixed together to constitute one average sample. In this way four average or compound samples were produced and were subjected to cultivation in the manner already described. The following results were obtained:—

	Number of Colonies per c.c.
High water, 11th April, 1903, 11.40 p.m.	373
5.5 a.m. to 5.35 a.m.	215
5.35 a.m. to 6.5 a.m.	191
6.5 a.m. to 6.35 a.m.	357
6.35 a.m. to 7.5 a.m.	298

"Tests were made for *bacillus coli* and for *bacillus enteriditis sporogenes;* neither organism was detected in 1 c.c. of the water.

"The results indicate that the open sea water contained a small number only of bacteria, an average of 287 per c.c.; and that what are ordinarily considered organisms of intestinal origin were absent.

"*Bacteria in Sewage 'Sludge.'*—The bacterial condition of the 'Sludge,' or matter separated from the sewage by sedimentation, may be stated before the bacterial examination of the estuary water into which the sludge is discharged is referred to.

"A comparison of the bacterial condition of the sewage sludge with that of the water of the estuary will indicate the reduction in the number of bacteria effected by dilution and by other means after the discharge of these organisms has taken place.

"*Number of Bacteria in* 1 *c.c. of* '*Sludge*' *at both Outfalls.*

Barking, 1903.	Bacteria which grow at 20° C.	Bacteria which grow at 37° C. (Blood-heat).	Spores.
April 29	121,000,000	60,000,000	6,250
May 2	126,000,000	74,200,000	8,100
,, 4	119,500,000	45,000,000	10,550
,, 5	131,000,000	64,000,000	11,800
,, 6	135,000,000	70,000,000	11,400
Average	126,500,000	62,640,000	9,620

Crossness, 1903.	Total Number of Bacteria.	Number of *Bacillus Coli Communis.*	Number of *B. Enteriditis Sporogenes.*
June 8	118,000,000	At least 1,000,000	At least 10,000, but not 100,000
,, 9	57,000,000	At least 10,000, but not 1,000,000	,, ,,
,, 10	149,000,000	At least 1,000,000	,, ,,
,, 11	163,000,000	,, ,,	,, ,,
,, 12	132,000,000	,, ,,	,, ,,
,, 13	177,000,000	,, ,,	,, ,,
Average	132,666,666	.....	.....

"The average number of bacteria in the sludge is therefore 129,583,333 per c.c.

"*Reduction in Number of Bacteria per c.c. introduced into the Estuary Water by Sewage Sludge.*—Several series of examinations have been undertaken at different times with the view of ascertaining the bacterial content of estuary water into which sewage sludge is constantly being introduced, and very many samples have been subjected to examination. The following statement briefly summarises the results obtained:—

"On April 2nd and 3rd, 1903, surface samples were collected throughout the length of the Barrow deep in the estuary immediately after the fleet of sludge steamers had deposited their sewage sludge. The average number of bacteria found in the water was 1,940 per c.c., as compared with 129,583,333 contained in the discharged sludge.

"On the 9th and 10th April, 1903, the surface water flowing from the Barrow deep into the river during an incoming tide was examined. This represented the estuary water which had been mingled with sludge in the estuary. Samples were taken every five minutes throughout the time of rising tide. The average number of bacteria found per c.c. was only 458.

"During September, 1903, further experiments were made with the view of ascertaining whether the diminution in the number of bacteria was due to sedimentation or to lateral diffusion by dilution. Immediately after the dark-coloured sludge had been discharged, a drifter, which was suspended from a float, and was cross-shaped and 8 sq. feet in area, and which

remained 10 feet beneath the surface (the depth at which the sludge is discharged from the bottom of the steamers), was immersed in the discoloured water. This enabled a boat to be kept in the middle of the area of discharge for the purposes of taking samples at different depths. The examination of these samples furnished the following results. Samples were taken every five minutes, and those collected during each hour were mixed to produce an hourly average sample.

Date, 1903.	Interval after Discharge of Sludge, at which Sample was Collected.	Total Number of Bacteria per c.c. found at following Depths.		
		Surface.	10 Feet.	40 Feet, or Bottom.
September 28	None	940,000	13,000	140
	One hour	32,700	2,910	690
	Two hours	1,470	790	320
	Three ,,	340	140	130
	Four ,,	380	220	...
,, 29	None	8,000	2,000	...
	One hour	21,400	580	...
	Two hours	6,200	700	...
	Three ,,	5,800	610	...
	Four ,,	5,300	610	...
	Five ,,	1,700	500	...

"These results seem to indicate that the number of bacteria per c.c. is not reduced by the sinking of the organisms to lower levels in the water, but by a lateral diffusion or mingling.

"The final series of samples, bacterially examined, consisted of water taken at different depths in the different channels of the estuary, of the bottom materials, and of the sands which were exposed at low water. In no case were bacteria found to be present in any considerable number."

The examination of the lower river shows that it is constantly undergoing bacterial improvement in its downward course, and that it does not even contribute materially to the increase of bacteria in the open estuary.

As a body which is primarily concerned with safeguarding the health of the people, the members of The Sanitary Institute will doubtless be desirous of preventing the continuance of any proved means of damage to public health and well-being, but they would surely strongly deprecate the publication of unnecessarily alarmist statements, as these are calculated to injuriously affect industries and to unnecessarily alarm the public. But it is undoubtedly the case that the official reports on the danger of contamination of shell-fish have shown that local sources of pollution have existed in the immediate neighbourhood of oyster layings, and have led to necessary improvements and safeguards.

The Study of Disease and of its Propagation.—The presentation to this Section of other papers bearing on specific diseases indicates that those who are the guardians of the public against the few surviving plagues, are keenly alive to the important duties which they have undertaken, and that they hail these recurring opportunities of arriving by conference and discussion at the best means of effecting their ends.

Purity of Food and Air.—One most important means of maintaining the public health at a satisfactory standard is to secure the reasonable purity of the food and drink consumed by the people, and to secure the purity of the air both within and without their buildings. Those who watch constantly over the quality of the supply to the food market and over the quality of water supplies are intrusted with functions of the greatest importance, and they should receive the support of all who wish well of their kind. Experience suggests that relaxation in such examination is impossible, and points to the necessity of increasing the frequency and rigour of such examinations. The public should welcome any improvement or extension in the working of the Food and Drugs Act, and should insist that the water supplies of the country should be proved to be satisfactory, not only as regards their original sources, but as they are supplied to the consumer. All experience shows that the public health is largely affected by the quality of the food and drink which is supplied to consumers.

In order to secure the purity of the atmosphere of towns very much remains to be done. Manufactures which emit offensive odours are generally banished from the immediate vicinity of densely populated areas, but the manufacturers are under no sufficient requirement to destroy their offensive emanations, a result which might generally be easily effected. Further, over our areas of dense population, not only the manufacturer, but, to an even larger extent, the private householder seems to make it a matter of little or no concern to avoid the emission of the objectionable products of the imperfect combustion of raw coal. The coal smoke of our great towns has become a serious nuisance and source of damage to materials and to health; and it must be remembered that it is accompanied by a very appreciable quantity of sulphuretted hydrogen, which is always present but is more especially evident in stagnant and foggy weather. This gas is not only very injurious to health, but does much damage by tarnishing metals and by impeding vegetable growth. The increasing use of coal-gas, petroleum and electricity for heating and motor purposes is advantageously reducing these particular sources of

atmospheric pollution, but the results thus far attained are very far from securing a satisfactory condition of the atmosphere. The combustion of much of our raw coal produces also a considerable amount of oxidised sulphur, the effect of which on living plants is bad, while its hygienic effect has been seriously condemned by those who are in the best position to express an opinion. The destructive effect of these acid sulphur products on leather fabrics and metals has also been placed beyond question. Naturally in ordinary weather these acid products do not accumulate in the air of a town: they become largely diluted and are frequently removed by falling rain: but their presence in the air within our buildings is cercertainly to be deprecated; and the desirability of extending the supply of coal-gas, which is not purified as far as possible from sulphur-compounds, for interior illuminating and heating purposes, should receive the thoughtful consideration of sanitarians and of householders. Speaking generally, the purity of the air we breathe receives at the present day less serious attention than the purity of our food and drink, and of materials which are used for various purposes.

It only remains for me to wish continued success to this important Sanitary Congress assembled in our great and important northern metropolis, and to express the hope and the belief that our deliberations may serve to advance the weighty interests which we have assembled here to promote.

CONGRESS AT GLASGOW.

CONFERENCE OF MUNICIPAL REPRESENTATIVES.

ADDRESS

By Councillor W. F. ANDERSON, J.P.,

Chairman of Committee on Health, Glasgow.

PRESIDENT OF THE CONFERENCE.

IN the remarks which I propose to offer you, as President of the Municipal Section of this Congress, it would be futile for me, in the presence of the expert sanitarians before me, to make any attempt to cover, even by a general survey, the progress of municipal sanitation. To look back upon the past and measure the distance we have travelled is undoubtedly useful and salutary, and in the case of the rapid growth and condition of our civilian population, is to my mind also somewhat depressing. The cry has already gone forth in many directions all over the world, and in no country more urgently than in our own, "Back to the Land." That cry I would repeat with emphasis now, if I could bring myself to believe there was in it the essence of practical politics or social salvation. We hear from writers such as Prince Krapotkin in his "Fields, Factories and Workshops," of the marvellous prodigality of nature in agriculture when she is wooed in earnest, and in ways suggested by scientific farming; while, on the other hand, we have such writers as Mr. Rider Haggard showing the drudgery, poverty, and distress which prevail in many parts of rural England, when capital is deficient, and where the housing of the labourers is almost as bad as, if not even in some respects worse than, it is in our city slums. We know of the disgrace of the "Bothy" system, of the rotten and damp condition of many of the dwellings in which our miners live, and we have recently had in our own city evidence of how the labourers in the country may contract a disease of the most virulent type (small-pox), and, all undetected, bring it from thence into the centre of a teeming population.

We have heard of "Garden Cities" into which our city workers may be enticed and segregated under conditions approximating those which existed in the imagination of Sir Benjamin Ward Richardson as he wrote his "Hygeia." But, co-ordinate with these, we see the growth of London, Liverpool, Manchester, Glasgow, and many others going on apace, spread-

ing out their stone and lime into the green fields, and converting their herbage into paved streets and row-upon-row of tenement property.

The ideal is the Country and the Garden City, and it is likely to remain an ideal only so long as the present land tenure is permitted, but the real is the apparently everlasting extension of large cities, as we find them at this present hour. Considerations as to the improvement of the real, therefore, appear to me of more practical utility than speculations in the region of the ideal.

To this end, therefore, I propose to say a few words on some of the aims the sanitary and social reformer ought to have in connection with the life and progress of civic populations. It has been said that in this city there is a tendency to do too much for the citizen—that, in fact, we seek to look after his interests "from the cradle to the grave." It is hinted, if not expressed, that by this means we are knocking all individuality and self-care out of him. We are trying to suckle him properly at his birth; to educate him during his adolescence; to provide labour, vehicular conveyance, and housing for him during his manhood; parks, music and libraries for him in his recreation; nurse him in sickness; and to provide him, in his senility and death, with a cheap and becoming grave.

Now, there might be some ground for the criticisms of the cynical philosopher if life in a city could be segregated to any extent, as we find it in the country areas. There, a man's or a woman's misdemeanours or carelessness, or want of moral fibre, or physical ability, reacts only on himself or maybe on his family; but, in a city, matters are different. Each unit of a town's population is so closely united in the matter of health and social welfare to those of his neighbour, that self-protection—leaving all altruistic considerations out of view—demands our closest attention.

I need not illustrate my meaning by examples. The ratepayers appreciate, only too well sometimes, the results that may flow from a careless or supine administration. The enormous cost of our hospitals, of our police, of our asylums, and poorhouses, proclaims the responsibilities of all cities, and demands means and expenditures for the alleviation of the misery and suffering of the poor and becomes a constant and ever-increasing drain on our resources.

It would occupy too much time to pass in review all the problems that meet us in our endeavours to find the right means towards our endless ends. You will be called to discuss the Smoke Problem by our esteemed Lord Provost; our Housing Problem by Sir Samuel Chisholm; our Drainage Problems by Dr. Crawford; and, finally, our methods of Health Administration by Mr. Cooper, the Chairman of Public Health in Aberdeen, all of which will be dealt with in a masterly manner; so I propose

to confine myself to the two extreme ends of the citizen's life, namely, his first days and his last.

One problem that has forced itself into my heart is the tremendous and seemingly irreducible infantile death-rate, and we had it on the highest authority of the President of the Sanitary Association of Scotland at the Stranraer meeting last Autumn, that one of the most important problems seeking early solution is that of infantile mortality. "One of the significent features of present-day statistics, and one calling for the serious consideration of sanitarians, is the high prevailing rate of infantile mortality in populous centres." While the general death-rates of our cities were on the decline, and while the death-rate from phthisis had fallen 10 per cent. in thirty years, while the death-rate in our hospitals for scarlet, enteric, and diphtheria had been reduced tremendously, yet the death-rate of our infants under one year was unduly high; not a whit decreased, but in some cases actually increased. In the census year (1901) the town of Burnley lost 226 out of every 1,000 infants born before they attained their first birth-day, Preston being next with a rate of 216 per 1,000. During the ten years (a time which is reliable for averages) from 1888 to 1897, the death-rates of infants per 1,000 births were as follows in the various towns:—

Liverpool	189	Dundee	176
Manchester	185	Glasgow	146
Birmingham	180	Aberdeen	141
Sheffield	180	Edinburgh	140
Leeds	178		

I was anxious to ascertain how English and Scottish cities compared with foreign cities in this important respect, and put myself into communication with our foreign Consuls in some sixty of the cities throughout the world. I selected the year 1902, and that from climatic conditions was not favourable to a high death-rate.

In Glasgow in that year 3,168 infants succumbed, representing a death-rate per 1,000 born of 128. The following are the corresponding rates of infantile mortality in the British towns:—

Liverpool	163	Dundee	143
Birmingham	157	Aberdeen	137
Manchester	152	Edinburgh	123

while the medical officer remarks in his report when giving those figures: "Amongst Scotch towns the infantile death-rate in Glasgow was exceeded in both Aberdeen and Dundee, while in the English towns referred to it was uniformly higher than in Glasgow."

TABLE *giving the Population, General Death-rate, and Infantile Death-rate of some of the Principal Cities of the World.*

City.	Population of City.	Death-rate per 1,000 in 1902.	Infantile Death rate in 1902, stated per 1,000 of Infants born.
New York	3,838,024	18·74	169
Paris	2,700,000	20·10*	142*
Berlin	1,965,000	15·64	181
Chicago	1,900,000	14·50	Unreliable.
Vienna	1,779,869	19·02	185
Philadelphia	1,408,154	17·67	155
St. Petersburg	1,248,122	21·80	250
Moscow	1,173,469	33·00†	Not obtainable.
Constantinople	875,000	14·47	Not obtainable.
Buenos Ayres	870,000	16·20	91
Rio de Janeiro	793,000	20·00	197
Warsaw	780,000	17·89	157
Hamburg	743,860	17·70	Not obtainable.
Buda-Pesth	733,358	19·20	144
St. Louis	700,000	17·00	182
Boston	600,929	18·78	145
Amsterdam	548,244	15·39	141
Naples	571,797	25·00	149
Baltimore	541,000	18·70	275
Barcelona	533,000	23·63	143
Munich	520,000	21·40	240
Milan	506,510	21·27	147
Dresden	495,400	17·43	192
Odessa	492,000	23·60	172
Marseilles	491,161	22·55	162
Rome	462,783	18·70*	Not obtainable.
Lyons	459,099	18·02	122
Prague	450,000	15·42	144
Breslau	445,766	22·70	215
Copenhagen	411,000	14·50	137
San Francisco	410,000	20·67	175
Cologne	407,000	20·50	Not obtainable.
Cincinnati	375,000	17·09	Unreliable.
Lisbon	360,000	27·52	Not obtainable.
Rotterdam	357,476	15·04	133
Turin	352,060	18·74	142
Yokohama	324,795	14·00	Unreliable.
Frankfort-on-the-Main	313,600	14·78	139
Stockholm	305,115	14·37	100
Riga	300,000	20·00	Unreliable.
Antwerp	294,669	17·00	163
Washington (D.C.)	289,596	19·99	Not obtainable.
Bordeaux	257,471	20·26	117
Christiania	225,709	14·66	100
Lille	220,713	24·63	221
Brussels	192,282	17·70	146
Oporto	171,910	29·10	Not obtainable.
Nagasaki	154,727	11·12	324
Seville	148,315	33·78	200
Gothenburg	133,625	14·80	Not obtainable.

* Figures for 1901.

† Figures for 1900.

From this list it will be noted that, in comparison with the larger cities in the world, the great cities in this Kingdom show favourably, as, out of the list I have read to you, no less than seven of the foreign towns lose annually one-fifth and over of the infants born.

It is rather curious that the city which bears the palm in this respect is the capital of the Argentine Republic (South America), with a population of 870,000, and a general death-rate of 16·2 per 1,000; while, next in the order of merit, we have the two Swedish and Norwegian cities of Stockholm and Christiania, with a record of 100 each.

Those three cities, therefore, give us what may be practically considered the "low-water mark" of infant mortality; and it appears to me that no city or town in the United Kingdom should be satisfied until it attains to a similar infantile mortality.

Extract from Annual Report of the Medical Officers of Health for 1903.

Infantile Mortality.

3,563 deaths of infants under one year occurred, which represents a death-rate per 1,000 born of 142, as compared with 128 in 1902. Of these deaths 3,116 were of legitimate and 447 of illegitimate children, representing rates of 132 and 298 respectively per 1,000 birth of each class. For several years this rate per 1,000 born of each class has been:

	1898.	1899.	1900.	1901.	1902.	1903.	Total.	Avg.
Infantile death-rate of legitimate children,	147	143	145	141	126	132	834	139
Infantile death-rate of illegitimate children,	302	286	286	269	244	298	1685	241

and the rate of both classes during several periods has been as follows:—

Average of five years,	1886—90	= 143	per 1,000 births.
,, ,,	1891—95	= 146	,,
,, ,,	1896—1900	= 151	,,
,, ,,	1901	= 149	,,
,, ,,	1902	= 128	,,
,, ,,	1903	= 142	,,

There can be no doubt that the question of legitimacy and congenital causes has a considerable bearing upon the problem; but even eliminating these, I am convinced, on studying the figures given for our own city, that the death-rate of legitimate infants is far too high. For instance, the death-rate of legitimate infants per 1,000 born in Glasgow in the year 1902 was 126, or about an eighth part of the total births in that category; whereas the combined rate for both legitimate and illegitimate in the three foreign cities I have named is a tenth and under.

It behoves all sanitarians, therefore—and not only sanitarians, but our legislators as well—to give the most earnest heed to this drain upon what after all must be considered as the life-stock of the nation, and to enquire what are the causes which produce this great waste of infant life. If we once get to understand and appreciate the true causes, it ought not to be for long a difficult matter to make up our minds as to the best courses to pursue in order to put a stop to it.

In a recent work by Dr. Leslie Mackenzie, of the Local Government Board, Scotland, he points out that about one-third of the total deaths of infants occur in the first month of life; and he is emphatic on the point that, of the three selected tendencies at work in child-destruction, unquestionably the most important is feeding, and proceeds :—

"If a correct diet is habitually insufficient in quantity, the nutrition is more or less arrested; if an incorrect diet is more than sufficient in quantity, the nutrition is perverted. In the one case starvation results, with the diseases following on it; in the other case special nutritional diseases result, such as scurvy, rickets, anæmia, purpura, etc."

This opinion is amply supported by Professor Glaister, the President of the Preventive Medicine Section of this Congress, who places prominently, as one of the causes, the wilful abstinence on the part of mothers from suckling their offspring, and the physical unfitness of mothers for that duty, owing to constitutional disabilities.

Of course, other causes are not lost sight of by either of the gentlemen named, viz., unhealthy housing, careless and demoralised parents, the daily absence of working mothers at their labour, insufficient clothing in winter, and so on, all of which require our careful consideration and attention.

My purpose to-day, however, is to lay special stress upon the question of the improper and insufficient feeding of infants, and the known prevalence of intestinal trouble, due to the improper food which is received by these little ones who are not suckled by healthy mothers. At a coroner's inquest recently held on the death of an infant in London, the mother said she couldn't understand why the baby didn't live as it got a share of all that was going, even up to the beer.

The Professor, in his presidential address last year at Stranraer, instances the remarkable results of an inquiry that was made at Boulogne into the death of 69 infants, who had died there of diarrhœa. Investigation revealed that, out of this total of 69, 8 were fed on the milk of the mother, 20 were brought up on the bottle, and 41 were fed on different forms of solid food. We may take this, I think, as an unmistakable indication of the cause of our infantile mortality.

In considering the report of the Royal Commission on the subject,

although their words apply more to the improper nutrition of children of school age, I fully adopt them in connection with the nutrition of infants. They say, *inter alia*:—

"The proper selection, cooking, and preparation of food may often be matter of serious difficulty to many parents. It would be, in many cases, an inestimable advantage could regular and sufficient meals—such as broth, porridge and milk, or bread and milk—be provided at a minimum cost. The preparation and cooking of these meals, where it is found necessary to provide them, ought to be regarded as one of the charges incidental to school management."

What is true in the case of school-children is equally true with regard to the selection, cooking, and preparation of infants' food. All those who are acquainted with the upbringing of the babies in the poorer districts of cities know well the amount of carelessness and ignorance which prevail, especially as to their feeding. Probably ignorance is more to blame than carelessness, for we all know that Nature herself—except in those who are absolutely debased—works strongly in the mother towards the welfare and comfort of her child. This has been so well recognised that we now find that various towns in this country, and also foreign cities, are now paying special attention to the preparation and distribution of milk suitable for the sustenance of healthy infant life.

It might be useful for the Conference to know what I have ascertained is being done in this connection in some of these. For instance, in *Barcelona* the municipality have a depot where such milk is sterilized and given *free* to the children of the poor.

In *Moscow* the municipality possess about 100 cows, the milk from which goes to the foundlings' home and the town hospitals. Private firms pasteurize their milk at a temperature of 56° Reaumur—equal to 158° Fahrenheit. It is sold there in sealed bottles, each holding about two and a half tumblerfuls, and costing $1\frac{3}{4}$d. a bottle.

In *St. Louis* (*U.S.*) all the dairy companies are required to treat their milk "as directed by the city chemist." This is usually done by sterilizing it; and recently a gentleman of that city donated to the Corporation a fund to be used in establishing plant to pasteurize the milk furnished to the poor of the city, which is to be supplied upon prescriptions from regular physicians.

From *New York* I have the information that there is a plant for sterilizing milk on Randall's Island, where poor and otherwise homeless children are cared for. This plant was gratuitously installed in 1898 by the Hon. Nathan Strauss, and the result, through a series of years, shows that the lives of many children have been saved in consequence. The

death-rate of the children in this Institution by this means was reduced from 42 per cent. in 1898, to 18 per cent. in 1901. Mr. Strauss also, with consent of the City authorities, established in the City parks and such public places, during the hot months of summer, depots for the gratuitous distribution of pasteurized or sterilized milk, as well as different grades of modified milk for sick children. The New York public generally may patronise these depots, and by paying at the rate of two cents. per pint, may consume all they desire on the premises.

The City of *Lyons* has nine depots, where sterilized milk is given out *gratis* to the poor.

In *Bordeaux* the milk is sterilized or pasteurized by the sellers, and sold at the average price of 3d. per litre or quart. *In that city all cans containing skimmed milk require to be clearly marked.*

The most of you are aware of what is being done at St. Helens, Liverpool, Salford, Bradford, and other towns in England. Here in Glasgow we have also made a start in this direction, and have established our first Municipal Dairy in Osborne Street, with suitable appliances and machinery for preparing and distributing to all citizens who may desire it sealed bottles of suitably modified and sterilized milk for the use of our infantile population at various ages from birth up to one year. I hope that all those who take an interest in the well-being of city children will take sufficient interest in the matter to visit that depot.

It now only remains to ascertain the best means whereby this suitable diet can be put into the hands of mothers and other guardians of infants. Recently we had a deputation from a body of ladies deeply interested in this question before the Committee on Health, by whom we were urged to take suitable and immediate steps to bring to the knowledge of the whole of our poorer classes the importance of properly feeding and rearing their little ones.

We have had for many years six lady inspectors, whose duty it is to visit daily in the homes of the humbler classes, in order, principally, to ensure therein a certain measure of cleanliness. They also advise the mothers in matters of ventilation and clothing, and report upon any evidences they find of infectious disease, overcrowding, nuisance, or verminous conditions. We will now be able to extend the usefulness of their services in the direction of infant dietary, and be able, through them, not only to urge both carefulness and cleanliness, but also to advise all mothers who are unable, from various causes, to suckle their own infants, where to obtain milk which will be quite suitable for them. Cards and explanatory leaflets will be left in their homes, and if necessary demonstrations will be given to the mothers with regard to

the proper use of the sterilized milk. Amongst the class where we want our bottles to go there is much coming and going, and I am hopeful that each labelled Corporation bottle will be a missionary of health, which will give direct refreshing and stimulating draughts of life's nectar, so that the massacre of the innocents may be stayed.

We have good reason to hope that what has been found so successful in the district of Salford known as "Green Gate" in reducing the infantile mortality there in 1900 from 224 per 1,000 births, to 178 per 1,000 in two years, will be equally successful in Glasgow; and if successful, I have no doubt that this municipality will not hesitate to provide, in each of the larger areas of the city, a similar depot where such milk will be obtained.

I might mention here that the Corporation intend to sell their modified and sterilized milk at a low cost to all those who have dairies in the city, in order that they may also be utilised for the purpose of bringing about its extensive recognition and use, and the price to the mother is to be fixed at 2d., 2½d., and 3d. for a 24 hours supply.

Should these proceedings and attempts to reduce our infant mortality not be successful, it may become necessary to consider seriously the advisability of obtaining stringent powers in order to prevent mothers, for a certain period prior and antecedent to confinement, attending to any other duties but those of looking after their homes and their infants; and municipalities themselves may have to go further than preparing and distributing suitable milk, by setting up, in all working-class districts, establishments under matrons, to which neglected and improperly cared-for babies may be compulsorily taken, fed, and cared for, with power to charge the cost against the parents or guardians.

But the municipal preparation and sale of infants' milk may safely be tried in the first instance, backed up, as it assuredly ought to be, by the domiciliary visits of lady inspectors. If it does not do all the good we expect, we know it will, at any rate, preserve many infants at present irretrievably lost through mal-nutrition; and mal-nutrition not alone caused by milk in wrong proportion of natural ingredients, but by milk poisoned by being placed in unclean vessels and kept in squalid and poisonous atmosphere, as well as by preservatives, such as are sold all over the country to farmers, dairymen, and others, viz., boric and boracic acids, formalin, salicylic acid, and other so-called milk anti-ferments. I fear the use of these substances in warm weather is more common than we suppose, during which there is every incentive given to the producer to sophisticate his milk in this way, in order to palm off his stale milk upon the unsuspecting consumers. It is, to my mind, a matter of surprise and

regret that the Government, notwithstanding its careful and exhaustive investigation into the whole question of the uses and abuses of these preservatives—and especially in the knowledge of the value of the pasteurising or sterilising processes—has, up to the present, done nothing to forbid their use in connection with our milk-supply, in the very preservation of which there is so much to be done to prevent it becoming putrescent in a few hours' time, so that what was meant for the food of the infant in many cases becomes its poison.

Let us now turn, and that very briefly, to a consideration of what municipalities have done, and might do, for their populations at the close of life. In looking over the replies received from the foreign cities communicated with on the subject, one is at once struck by the fact that a large proportion of them appear to have given more consideration to the necessity of provision for the dead than for those who are alive.

In Glasgow we have hitherto done nothing towards the establishment of municipal cemeteries, although the question has, for a considerable time, been under special consideration by a committee of the Corporation.

Most of our larger and growing towns have their burial grounds in the hands of private interest. By the rapid growth of cities these are now, for the most part, situated in districts surrounded, more or less, by the population. Several of these burial-grounds in Glasgow have long since ceased to be used for burial, owing to the fact that as they became filled up they constituted a menace to the public health. Others of later date sprang up on the environs of the city, but these in turn are now also being surrounded, and as the city extends north and south, east and west, will eventually find themselves (say, within the next twenty or thirty years) equally in the centre of rapidly increasing dwellings. Moreover, the cost of burial to the humbler classes must always be a matter of serious import. Even the humbler citizen has a proper desire to possess for himself and his family what is known as a "private lair," which he can feel assured will be consecrated entirely to his own use and prevent him having a pauper's funeral. A single lair is not fitted, under the new regulations, to contain more than four coffins of ordinary size at the most; and even this costs in Glasgow from £2 10s. to £3 10s., which, together with the funeral expenses, imposes a considerable drain upon a poor man's resources.

There are many among us who are not quite satisfied that the provision of ground, wherein all at the end have to be laid, is a matter which can be considered to be fairly suited for the acquirement of profit; but, leaving this consideration on one side, there is the other and larger consideration that such grounds, in private hands, are always liable to the

abuse of over-burial. In this country this subject has not yet obtained the practical recognition which appears to have been given to it abroad; and if you will bear with me I will, very shortly, give you a synopsis of what has been done in this connection there.

In Copenhagen there are municipal burying-grounds extending to 275 acres, the lowest charge for a lair being 16s. 6d. In addition to this, poor people of the city obtain their ground free, and this is not considered against them as poor relief.

Hamburg has a large and beautifully laid out cemetery about three miles from the town, some 321 acres in extent. A private lair giving rights for twenty-five years costs 10s.

The municipality of Warsaw own three cemeteries, extending to 332 acres, in which lairs can be obtained for £1 5s. 5d. Paupers are buried there at the expense of the municipality.

In Odessa (Russia) all the public burial-grounds are the property of the municipality. They are five in number, and cover an area of 450 acres. What are known as "rotation graves" are given free to the poor.

In Palermo (Italy) the cemeteries are now a municipal monopoly, as also are the funerals.

Barcelona has seven municipal cemeteries, extending to about 95 acres, the cheapest lair being about £2.

Lyons has three municipal cemeteries, extending to 79½ acres, in which all poor persons have free burial.

The municipality of Lille possesses two cemeteries, 92½ acres in extent, interments in which are free. Special portions of ground, however, are sold to those who apply at a rate of 12 francs per square meter (equal to 29s.) for a concession of fifteen years.

Munich has fourteen municipal cemeteries, the price of the cheapest lair being 25s. for twenty-five years.

Turin has sixteen cemeteries owned by the municipality, and extending to 75 acres or thereby.

In Oporto the municipality possesses two public cemeteries, extending to 42 acres. The cheapest lair is £1 15s. 6d.

Seville possesses one municipal cemetery, 48 acres in extent. The cheapest lair is 19s. 9d.

In Vienna there is one large public cemetery and twenty small ones, which have become the property of the city on union with certain suburban districts. The total area extends to 629 acres. A lair here can be had for 5s.

Buda-Pesth possesses ten municipal cemeteries, 45 acres in extent. The cheapest lair is £1.

The City of Berlin possesses a municipal cemetery of 62½ acres, in which a lair can be obtained for 8s.

Amsterdam has two municipal cemeteries, 55 acres in extent, in which 8s. 3d. is charged for one interment, but no permanent occupation of the lair is given for this price. The cheapest private lair costs £3 6s. 8d.

Breslau possesses three cemeteries, 206 acres in extent, the price of a lair being 4s. 11d.

Gothenburg has a municipal cemetery of 133 acres, the price of the lair being £2 4s. 5d.

Lisbon has six municipal cemeteries, about 70 acres in extent, the cheapest lair being 7s. for a period of five years.

The City of Moscow possesses eight town-cemeteries, under the management of the ecclesiastical authorities, their area being 399 acres. Private graves cost 20s. 10d., but a poor person may be interred therein at the cost of 1s.

Buenos Ayres has two municipal cemeteries, 194 acres in extent. A charge of 15s. 6d. is made per lair for five years.

In Frankfort-on-the-Main there are four municipal cemeteries, extending to 82 acres. The cheapest private lair is 12s., and the lairs all revert to the town in twenty years.

Paris possesses twenty-two cemeteries, those within the city extending to 210 acres, and those without the city to 541 acres. The most important of these is the famous *Père-la-Chaise*, which has now become so proximate to the population that the municipality have determined to remove every body within it and all the tombstones, at the public expense, to a more suitable site in the environments of the city. No common graves are allowed in Paris in any cemetery within the city precincts, and a concession of ground for five years costs 50 francs, or £1 19s. 7d.

The municipality of Marseilles possesses fourteen cemeteries; the town or principal cemetery covers about 110 acres, and the others are of various dimensions, not given. In the town cemetery the cost of a lair is high, the cheapest being £4 18s.; but the lairs in the suburban cemeteries are cheaper, amounting to about 80 francs, or £3 3s. 4d. The concession is for fifteen years.

In America the Cities of New York, Brooklyn, Boston, Washington, San Francisco, and Philadelphia all possess municipal cemeteries,

but I need not weary you by detailing their extent and the cost per lair.

I have gone into detail in connection with these foreign towns to show you that there they consider the question of burial is quite a right and proper thing for the municipality to take in hand.

In our country I find there are 55 municipalities in England, five in Scotland, and one in Ireland which own cemeteries; and we have been informed by Mr. Lindsay, our police clerk, that there exist sufficient legal powers in the Burial Grounds (Scotland) Act, 1855, to enable any Corporation to acquire land for this purpose, and also to purchase existing cemeteries from Companies now owning them. Municipalities, therefore, have plenty of precedent, and also apparently sufficient legal power to make it their business to see that their citizens may be put in possession of a grave at the cheapest rate consistent with economy; and the question for sanitarians to consider is: Is there any material advantage to be gained to the public health from their possession and maintenance by a Corporation? This is really the only point which, as a meeting of professed sanitarians, you are called upon to consider.

I have already indicated, in passing, the risks that may accrue to public health in growing communities from (*a*) the acquirement by private companies of improper sites for this purpose, and (*b*) the risks which more or less always attend the burial of bodies by those, or the servants of those, whose interest it is to make a profit out of their business. Let us consider how far the elimination of these two factors would be attained under municipal possession and control.

In considering, firstly, the acquirement of ground for this purpose by a municipality, we are compelled, I think, to admit that private interest would compare unfavourably. The "popularity" of a cemetery—if I may use the term—will, no doubt, to some extent, be regulated by its distance from the population it is designed to serve, and, of course, on its popularity will, to a large extent, depend its power of producing profit or sufficient interest to entice private capital; hence one of the main considerations to a private company would be the securing of a suitable site as near as possible to the centre of a city. This consideration would not weigh with a corporation, whose interest is not profit, but the safeguarding, not only for the present but also for the future, of the health of the people. They would therefore seek, in my judgment, to secure suitable sites as far removed as possible from the centre of the city; and, in the exercise of the powers they possess, would doubtless take means to prevent the encroachment of dwelling-houses upon the immediate environs of the cemetery.

Under *(b)* the constant tendency, notwithstanding the regulations which have been laid down for the interment of human remains by private companies, is to dispose of their ground to the best financial advantage, and graves have been discovered in these private cemeteries filled with coffins with little or no earth between them, and with insufficient earth from the topmost coffin to the surface to thoroughly deodorise the emanations which may arise from the remains beneath. It would take an army of inspectors to be present at all the burials in privately-owned cemeteries in order to exercise a sufficient check upon this tendency, and hence a municipality has no sufficient guarantee that their regulations are, in all respects, properly adhered to. Under municipal ownership and control this danger would be entirely eliminated, as there would be no inducement to any person having the management or control to do otherwise than bury in every case strictly in accordance with the rules.

Thus, under both counts, municipal ownership and control seem to have a manifest advantage over those of private companies. It is not sufficient to urge that there has been no evidence of danger to the public health from any of the privately owned cemeteries. I apprehend that the danger from these places is very subtle in its nature. When one comes to consider the mass of putrefaction which must be going on continuously in burial-grounds, and the emanations which, either for want of sufficient earth, or especially for want of sufficient herbage over the graves, may be wafted unperceived over and among the population, it is not difficult to appreciate the danger. In any case, I am inclined to come to the conclusion that, in all cities where there is a large poor and labouring population, and where infectious diseases of one kind and another are constantly in evidence, the safest policy, as well as the most economical, is for the municipality to possess its own cemeteries.

I think I have now at sufficient length given you my views upon these two aspects of city life. There are, of course, other problems awaiting our attention and solution, but I have refrained from indicating them, first, because of want of time, and second, because the two I have referred to—and especially the first one—lie very close to my heart. In the multitude of papers and addresses to be given at this Congress, I have no doubt both of these subjects will be more suitably handled than I have been able to handle them, but I can only assure you that I have done what I could to bring them before you at this stage of the proceedings, in order that they may be so pondered by some of you as to enable you to contribute, in some of the other Sectional Meetings, to any discussions which may arise bearing upon them.

CONGRESS AT GLASGOW.

CONFERENCE ON INDUSTRIAL HYGIENE.

ADDRESS

By Councillor JAMES STEELE, J.P.,

Vice-Chairman of Committee on Health, Glasgow.

PRESIDENT OF THE CONFERENCE.

IN opening this Conference of those interested in the vast and all-important subject of industrial hygiene, I intend to confine myself to the expression of a few thoughts which cannot fail to strike one who lives and moves in such a city as Glasgow. The old motto of Glasgow is: "Let Glasgow flourish by the preaching of the Word"; but the axiom approved of her citizens is that of the wise man: "The hand of the diligent maketh rich." The axiom might quite truthfully be inverted into: "The desire for riches maketh the hand diligent." The great majority of the people never will be rich, and at the beginning of this century we seem to be more than ever confronted with the problem of how to enable the great mass of our citizens to be, not rich, but fairly capable to sustain themselves and their families in healthy life. It is the merest commonplace to observe that the advancement of civilisation creates wants and desires which only serve to increase the difficulty of obtaining a moderate competency. The increasing intensity of competition, coupled with the difficulties of making home agriculture a paying industry, has aroused general interest. Each succeeding census is exhibiting a continued depopulation of the rural parts of the country, and the swelling of already crowded cities. The evil is recognised, but its removal is still, I fear, far from accomplishment. Nay, this crowding of country people into the towns in search of employment continues persistently, despite the fact that, of all employments, that of the agriculturist is far and away

the healthiest. Dr. Tatham, of the Registrar-General's Department, in London, has shown that death-rates of agriculturists, not only from all causes, but also from respiratory and circulatory diseases, are much lower than those of almost any industrial pursuit or calling in a city or elsewhere. I give you a few instances. He puts the general mortality figure of agriculturists at 602, whereas the comparative figures for certain occupations considered fairly healthy, are as follows: bookbinders, 1,060; printers, 1,096; hatters, 1,109; hairdressers, 1,099; tailors, 989; drapers, 1,014; and shoemakers, 920.

But when we come to the comparative mortality figures of those industries from phthisis and diseases of the respiratory organs, the difference is even more marked. If we consider the ratio of agricultural mortality at 100 from this class of diseases, he shows that for bookbinders it is 246; for printers, 244; for hatters, 231; for hairdressers, 221; for tailors, 211; for drapers, 200; and for shoemakers, 198; in all but the last more than double that of the men employed on the land and working in the open air in the country.

But when we come to consider the mortality of the more unhealthy industries, such as potters, cutlers, filemakers, glassmakers, copperworkers, iron and steel workers, and such like, we find the figures for general mortality ranging from 1,300 to 1,700, as against 602 for agriculturists; and in the mortality from lung diseases, figures ranging from 300 to 450 in place of 100.

When one considers the import of these figures, and at the same time remembers the conditions surrounding many of our agricultural labourers—conditions stated by the report of the last Royal Commission that considered the subject, to be "physically and morally unwholesome and repulsive"—it is seen that the whole subject of industrial hygiene is one which, instead of occupying the attention of this Congress for one day, might well have been earnestly pondered and discussed during its whole sitting.

The term Industrial Hygiene presupposes industrial disease; and we all know that there is almost no occupation or trade that does not, in some way or other, operate against the health and vitality of those who follow it. Masons and quarrymen contract phthisis; potters, painters, and plumbers, plumbism and colic; woolsorters, anthrax; lucifer-match makers, phossy jaw; coachmen and cabmen, rheumatism; and all through the gamut of industry one can detect the wail of a physical suffering which is more or less peculiar to each.

In connection with many of them there is no oversight by the State or by the sanitary authority. The mason may hew the sand into his eyes

and lungs, and the plumber may inhale lead and zinc fumes to his heart's content without let or hindrance from anyone. Although perfectly well recognised as dangerous to life, if reasonable precautions are not used, many of our more common industrial pursuits receive no legal recognition. In these the axiom seems to be, Man, protect thyself! There is not even an effort made to enlighten the ignorance of those who, when young, enter upon them, and it is only when disease has set in and a doctor is consulted that the victim may come to apprehend the consequences of his negligence of hygienic laws. On the other hand, there are occupations over which the State seeks to, and does, exercise a control. We have State regulation of what are known as the special dangerous trades, some of which I have referred to. There are the Alkali Works Acts, which control the manufacture of sulphate of soda, sulphate of potash, and all other works where copper ores are treated by common salt or other chlorides, by which any sulphate is formed or muriatic acid is evolved; and at present there is a Consolidation and Amending Bill before Parliament to further strengthen the hands of the Government inspectors, who, I may say in passing, are all too few in number to adequately perform the immense amount of useful work that lies to their hands all over the country. I daresay many of you will scarcely believe that, for the whole of Scotland, there is only one inspector appointed by the Crown to carry out the provisions of the Act, and that, besides his duty in this respect, he is expected to devote his attention to the requirements of the Rivers Pollution Acts. These Acts certainly provide the steam, but, for want of men, the machinery is practically at a standstill. Both of these Acts, and particularly the industries comprehended within the four corners of the Alkali Acts, demand not only constant watchfulness at all hours, but also carefully conducted chemical tests to ensure that the dangerous acids, fumes, vapours, and gases constantly evolved do not issue to the outer air in greater proportion than is laid down in their sections, even to the extent of one-fifth part of a grain in each cubic foot of air, smoke, or chimney gas escaping. Yet, so far as I know, no assistant is provided for the purpose to any alkali works inspector by the Government.

It is true that one of these sections of the Acts provides for additional assistance should any sanitary authority call for it, but only on the understanding that the demanding authority pay one-half of his salary, and that without having any say in his appointment, his duties, or his dismissal. It is not surprising that few sanitary authorities have made such a demand, however needful may be the case. So far as I can learn, only one in the kingdom has done so, viz., that of South Lancashire. When I tell you

that the first schedule of the Bill now being considered names 21 different kinds of chemical manufactories, requiring fairly constant supervision, you will be able to appreciate to some extent the parsimony of our governing authorities in their administration of this most important branch of industrial hygiene. I now pass from this to cast a brief glance at another branch of our subject, viz., the so-called unwholesome trades. Those are specified in the Public Health Acts, and comprise such factories as blood-boilers and driers, gut-scrapers, fellmongers, glue-makers and soap-boilers, tallow-melters, bone-boilers, tripe-cleaners, manure manufacturers, and such like. Unlike the 21 different kinds of factories under the Alkali Acts, these are placed under the supervision and control of local sanitary authorities, who are empowered to license or withhold license from those who carry them on, and make by-laws for the conduct and structural requirements of such businesses.

The nuisances likely to be created in these works, for the most part consist of offensive organic vapours evolved from the treatment of decomposing animal substances by fire or steam heat. There are 57 such works in this city of Glasgow.

Although the vapours arising from the processes carried on therein are more distinctly offensive to the nostrils than those emitted from the alkali works, I apprehend they are not so dangerous, neither to those employed in such places nor to the public. Notwithstanding this, being constantly under the eye of a large staff of inspectors employed by local authorities, they receive a share of attention out of all proportion to that given to the alkali works. If any of them cause the emission of noxious or offensive fumes, the citizen is not slow to apprise the local authority of the fact, and steps can at once be taken to investigate the cause and prevent its continuance. There is little or no evidence, that I am aware of, to show that such businesses are specially inimical to the health of the workers. The terrible diseases which arise among those engaged in the alkali class of industries are absent from the employees in the unwholesome trades, probably because of the fact that in the vast majority of them, dust is conspicuous by its absence, and the corrosive action of acids and alkalies is absent except in rare instances.

I have already shown you the excessive mortality of several of the dust-producing trades, and we have it on the highest authority that, whether the dust be of an absolutely poisonous nature or merely acts on the skin or organs of the body in a mechanical way, it invariably plays the prominent part in occupational or industrial diseases. Yet the works I am now speaking of, because they tend to spread abroad in the atmosphere

vapours which are obviously offensive and liable, in sensitive persons, to produce nausea and even vomiting, bulk largely in the public eye; although, as a matter of fact, in the eye of science and experience alike, they are not so pronouncedly harmful as many of the industries to which less, or even no attention is given. It is not to be understood by this that I am inclined in any way to deprecate the assiduous attention and inspection given to this class of trade. My object is rather to concentrate attention on those that are dust-producing, and ask for them, and the workers in them, as great a consideration and protection as are afforded by the Public Health Acts with regard to the offensive trades. To my mind the conclusion is irresistible that, in this regard, we are straining at gnats and swallowing camels.

Then, lastly, we have all the industries to which the Factory and Workshop Act applies. Their name is legion, and the workers in them, old and young, male and female, form the great mass of our industrial population. The Factory Act seeks not only to protect the workers (women and young persons) from the avarice of the employers in the regulation of the hours of labour, but also makes certain stipulations as to the adequate ventilation, temperature, dryness of air and floors, sanitary conveniences, and other sanitary conditions. There are also, as you know, provisions for safety against fire, and safeguards against accidents from machinery. The Act is very minute and comprehensive, but in several particulars it could well afford to be more so. I have referred to the special danger of dusty occupations. There is almost an equal danger in the factories and workshops under this Act in the continual respiration of vitiated or pre-breathed air.

In 1902 I observed in the minutes of our health committee a report prepared by our chief sanitary inspector regarding the sanitary condition of 570 of our workshops and work-places. In 37 of these, samples of the air breathed by the employees were taken, and submitted to our corporation chemist. The natures of the trades were various: tailors, costumiers, jewellers, calenderers, dressmakers, bootmakers, restaurateurs, underclothing manufacturers, fishing-tackle makers, japanners, milliners, etc. The average quality of the air in the workrooms of the eight tailors was very bad, showing 28 parts per 10,000 volumes of carbonic acid. In certain instances it rose as high as 33, 36, 39, up to 46 parts per 10,000; while only in four out of the 37 did it come under 10 parts per 10,000, which, by most experts, is considered the maximum of impurity permissible. What is the cause of this state of matters? Is it not largely due to the fact that the standard of working air space prescribed by the

Factory Act is too low to render natural ventilation possible? By our local Acts, no citizen is allowed to sleep in any dwelling-house under 400 cubic feet of free air space, while under the Factory Act he is allowed to work in 250. Surely there is an anomaly here? It seems clearly to be common sense (whatever science may tell us) that a working animal requires more fresh air in labour than when asleep. Yet in our legislation we have conditions for the working out of this principle reversed.

The Act makes it compulsory, where necessary, that the occupier of a manufactory who employs machinery shall provide suitable mechanical ventilation, but there is no such power given with respect to workshops and work places without machinery. I look upon this as a grave defect in our Workshops Act. In these days of electrical energy, brought, so to speak, within the reach of all, surely the legislature, in seeking to protect the industrial population, might have armed local authorities who have put down electrical plant with the power to demand the installation of fans in such badly-ventilated workrooms as I have referred to. They might have gone further, and specified clearly in the Act the amount of carbonic acid pollution permissible as a maximum in all city workrooms.

Such are a few of the thoughts that have occurred to me in connexion with industrial hygiene. Doubtless, in the course of our discussions to-day, we will have many things before us that will bring us nearer a proper understanding of this all-important subject.

I am satisfied if I have succeeded to any degree by these general remarks in arousing your interest in the work that lies before us.

CONGRESS AT GLASGOW.

CONFERENCE OF MEDICAL OFFICERS OF HEALTH.

ADDRESS

By SIR CHARLES A. CAMERON, C.B., M.D., F.R.C.P.I., F.R.C.S.I., D.P.H.,

Professor of Hygiene and Chemistry, R.C.S.I.; Medical Superintendent Officer of Health for Dublin.

(MEMBER.)

PRESIDENT OF THE CONFERENCE.

THE STATUS OF THE PUBLIC HEALTH MEDICAL SERVICE IN IRELAND.

IN opening the proceedings of a Conference of Medical Officers of Health, a President's address should perhaps be of a general nature, referring to the United Kingdom, and not confined to a portion of it. I have therefore to apologise for limiting my observations to Ireland. I venture, however, to hope that a brief account of the status of the public health medical service in that country may not prove wholly uninteresting to this Conference.

In 1866, the Corporation of Dublin appointed a medical officer of health under the provisions of the Sanitary Act, 1860. No other medical officer of health existed that year in Ireland or for several years following. The appointments of such officers was optional until 1874. In that and following years a large number of consulting sanitary officers were appointed by the sanitary authorities of the larger towns, and by the Boards of Guardians of the Poor Law Unions, the sanitary authorities for the rural districts.

The Public Health (Ireland) Act of 1874 created two classes of medical health officers, namely, medical officers of health and medical

superintendent officers of health. The Local Government Board constituted a third class, consulting sanitary officers. The Poor Law (dispensary) medical officers became *ex officio* medical officers of health. The consulting sanitary officers might or might not be Poor Law medical officers. They were to be elected by the sanitary authorities, subject to the approval of the Local Government Board. For some time no medical superintendent officer of health was appointed.

In 1878, the Act of 1874 was wholly repealed, and a new one, embodying, with additions, about twenty sanitary statutes, was enacted. It also provided that the Poor Law medical officers should be *ex officio* medical officers of health.

In 1874, the Local Government Board issued a sealed order to the Corporation of Dublin directing them to appoint a "medical officer of health" and a "consulting sanitary officer." I was appointed to the former office, and Dr. Mapother, who had borne that title since 1866, became consulting sanitary officer.

On the passing of the Public Health Act of 1878, the Corporation were directed to appoint a "medical superintendent officer of health" and an "executive officer of health." Dr. Mapother was elected to the former office, whilst retaining the position of consulting sanitary officer, and the secretary of the public health committee had his designation changed to executive sanitary officer. Dr. Mapother resigned his position as superintendent medical officer of health, in 1879, and I succeeded him.

In 1882, on the death of the executive sanitary officer, his duties were added to mine, and I was given the whole charge of the sanitary department. Finally Dr. Mapother received a pension, and the position of consulting sanitary officer for Dublin was terminated. Although I am now medical and executive officer of health and public analyst for Dublin, I think it extremely improbable that such a combination of offices will continue after my time. The work of sanitary authorities is yearly increasing in extent and variety, and division of official labour is becoming more and more desirable in the larger sanitary districts.

The consulting sanitary officers appointed by the Boards of Guardians were, for by far the greater number, the medical officers of the workhouse infirmaries. In some cases the *ex officio* health officers and non-union officers were also consulting sanitary officers. Their maximal salary was £50 a year; in only a very few instances some were paid by fees, but the majority received salaries of from £5 to £20 per annum. The Local Government Board of Ireland have recently decided that vacancies in these offices are not to be filled up.

The duties of medical superintendent officers of health as defined by the Local Government Board differ only in one important respect from those of the consulting sanitary officer, namely, that they include the supervision of the work of the *ex officio* officers. Perhaps in process of time the remaining consultants will become medical superintendent officers of health. The following is an up-to-date list of county boroughs and urban and rural districts in which medical superintendent officers of health are appointed:—

District	Salary	District	Salary
Dublin County Borough* ...	£1000	New Ross Urban District ...	£15
Belfast County Borough ...	500	Rathmines and Rathgar Urban District	50
Cork County Borough	300	Tralee Urban District	25
Limerick County Borough .	100	Castlereagh (Belfast No. 2) Rural District.....	20
Londonderry County Boro.	350	Belfast Rural District	12
Waterford County Borough	60	Castlebar Rural District (vacant since March, 1903) .	15
Ballinasloe Urban District...	15	Glennamaddy Rural District	10
Bray Urban District (vacant since September, 1903) ...	30	Dublin, North, Rural District	20
Drogheda Urban District ...	40		
Kingstown Urban District...	100		
Lurgan Urban District	25		

By the Irish Local Government Act of 1898, the Boards of Guardians ceased to be sanitary authorities. The districts under their control were formed into rural districts, and placed under the government of "Councils," who have the power of appointing medical superintendent officers of health. They have to pay the salaries of the *ex officio* officers of health.

On the passing of the Public Health Act in 1874 the Dublin Corporation were requested by the Local Government Board to fix the salaries of the *ex officio* medical officers of health in the city dispensary districts. The sum fixed for each was £25 a year. As there were fifteen dispensary physicians the total sum given to them was £375, and subsequently on the appointment of another additional officer, £400 a year. There are now no fewer than twenty of these officers in the city of Dublin; population 292,000. A curious circumstance in this case was the fixing of salaries by an authority who did not pay them, for until 1898 the city district officers were paid by the Boards of Guardians. Agreeably to the provisions of the Public Health Act of 1874, the Treasury paid one half of the salaries of medical officers of health and sanitary inspectors, who were, in conse-

* Medical Superintendent Officer of Health, Executive Sanitary Officer and Public Analyst. Allowed £120 a year for laboratory expenses, the use of a laboratory, and provided with some assistants.

quence of the passing of the Public Health Act, appointed; the Treasury also determined to give one half of any increases of salaries of existing health officers. This arrangement was most unfair to Dublin, which was in effect punished instead of being rewarded, for having appointed a large sanitary staff when they were not compelled by law to do so. On the other hand, the towns in which no sanitary staffs, or totally insufficient ones, existed, forthwith appointed their sanitary officers, and received from the Treasury, through the Local Government Board, a moiety of their salaries.

It is to the credit of the Irish Local Government Board that on the passing of the Local Government (Ireland) Act, they rectified the injustice under which Dublin had suffered for more than twenty years. The Board have now the disposal of the grant to sanitary authorities, and they pay half the salaries of all the public health officers who were in existence in 1874, or the persons who had succeeded them. The sum received by Dublin for the year 1903 was £2,091.

There is no reference to the subject of a retiring allowance to medical officers of health in the Public Health Act. In the case of an officer giving his whole time to the service of his authority, it would seem likely that, as in the case of other municipal whole-time officers, he would be entitled to a pension.

As I am not a whole-time officer, the Corporation of Dublin was so good as to get power to grant a pension to their medical officer of health. The 93rd section of the Dublin Corporation Act, 1890 (53 & 54 V., c. ccxlvi.) enacts that, with the approval of the Local Government Board, they may grant a retiring allowance not exceeding two-thirds of his salary to "any medical officer of health of the Corporation."

A similar section was passed subsequently in an Act promoted by the Corporation of Belfast.

When the Dublin Corporation Act was passed, the payment of the district medical officers of health was made out of the Poor Rate. A question has now arisen: Does section 93 of the Corporation Act apply to them as well as to the medical superintendent officer of health? Two district medical officers of health, having resigned, applied for pensions to the Corporation. The law agent of that body considered that the Corporation had no power to grant such pensions, as they (the district officers) were not contemplated when the Corporation Act of 1890 was obtained, and as no provision for pensions was made in the Act of 1878.

The Irish Medical Association, therefore, submitted a case to Mr. Matheson, an eminent King's Counsel. His opinion is too long to be read

to the Conference, but I give it in the form of a note (p. 317). As regards the Local Government Board, their views seem to be rather in favour of those of the Corporation's law-adviser.

So long as the payment of the medical officers of health was in the hands of the Boards of Guardians, it was usual to take into consideration, in determining the amount of their retiring allowances, their income from all official sources, vaccination and registration of births and deaths fees, and public health salary. In future the Boards will, in all probability, take no account of their income as sanitary officers accruing after 1898. It is only common justice to the medical officers of health that power should be given to the sanitary authorities who have succeeded the Boards of Guardians to grant retiring allowances to the medical officers of health. Indeed, it is to be hoped that at no distant date the Poor Law officers and medical officers of health will be placed as regards pensions in the same position as civil servants. At present the granting of pensions is wholly optional with the local authorities.

The *ex officio* medical officers of health are dissatisfied with the smallness of the salaries which they receive: for all Ireland they average £18 6s. a year. The Corporation of Dublin proposed in 1901 to increase their officers' salaries from £25 to £40 per annum, but the proposal was not approved of by the Local Government Board.

No inconsiderable proportion of the *ex officio* officers would prefer not to have any sanitary duties imposed upon them, believing that they prejudice their medical practice. In visiting their patients nuisances come under their observation, to which they feel obliged to direct the attention of the sanitary authority. Amongst the poorer, and to some extent the middle, classes, there is often an objection to have their dwellings disinfected after the occurrence of infectious disease in them. They may think it unnecessary or may dislike the inconvenience it causes them. In many cases the dispensary physician is not called in, and some other medical man's advice is sought for in the hope that he would not insist on disinfection being performed by the sanitary authority.

Another reason why the dispensary physician is often ignored, is due to the objection some persons have to go to a fever hospital, or to allow persons in their charge (except employees) to be removed to it. As the medical officer would in all probability insist on the removal to hospital of a fever patient unprovided with proper accommodation, or who was likely to endanger the health of persons residing in the same house, a physician less likely to be so uncompromising is sent for.

It has been suggested that in the next Public Health Act for Ireland

ex officio medical officers of health should be abolished. A Commission appointed in 1900 by the Lord Lieutenant to inquire into the causes of the high death-rate in Dublin, recommended the abolition of *ex officio* officers of health in Dublin, and the substitution therefore of an assistant whole-time officer. I am inclined to think the recommendation a good one, if it could be carried out without inflicting pecuniary loss on the present officers. As regards Ireland at large, it would be difficult, or impossible, in many a district to get any medical man other than the Poor Law officer, for the simple reason that he is the only medical man in it. Instead of abolishing the *ex officio* officers, it would be better to institute medical officers of health in connection with the County Councils. The appointments should be made compulsory, and the officers should give their whole time to their duties. They should have a small number of sanitary inspectors, with jurisdiction extending over the whole county. Rural sanitation is sadly neglected in Ireland, and practically there are no whole-time sanitary sub-officers in the rural districts. The relieving officer is generally also the sanitary sub-officer, with a trifling salary as such.

An energetic medical superintendent officer of health would find ample and useful employment in every county in Ireland. Much of the milk supplied to towns comes from farms the hygiene of which is very insufficiently enquired into. Nuisances of all kinds are to be found in the country as well as in the town. Many of the former cannot be dealt with by the local medical officer of health; he cannot get his petty local Board to deal with them, or perhaps he finds it incompatible with his interests to take too energetic action as regards them. Those responsible for an insanitary state of things are his patients, or the members of his Board of Guardians. It is not worth his paltry salary of £10 or £15 a year to offend them. Notwithstanding the unpleasant position in which hygienic activity places the rural health officer, many of them do their best to remedy insanitary evils, and suffer for their activity and zeal.

A county medical officer and two or three sanitary inspectors, independent of local influences, irremovable except for misconduct, and entitled to a pension, would do more good than can ever be accomplished by the existing sanitary organizations. The nature of the duties of medical officers of health and medical superintendent officers of health are set out in a Sanitary Order of the Local Government Board to the County Boroughs of Dublin and Belfast.

DR. SPEEDY'S CASE.

Copy of Extract from Opinion of Mr. Matheson, K.C.

I am of Opinion that the Corporation have power to superannuate Dr. Speedy under the powers hereinafter referred to. The position of Medical Officers of Health appears to have been created by Section 11 of the Public Health Act, 1878, by virtue of which the Medical Officers of every Dispensary District became Sanitary Officer under the Title of Medical Officer of Health—at such additional salary as the Sanitary Authority with the approval of the Local Government Board should determine. Until the passing of the Local Government Act, 1898, Dr. Speedy was, as I understand, the Officer solely of the North Dublin Guardians who were the Sanitary Authority of his District. Assuming this to be so, there is no section in the Local Government Act expressly transferring him to the Corporation, as Section 115 (1) which carries out the general transfer of Existing Officers only deals with officers employed in that business and not in any other business of the former authority, but I think that he is impliedly transferred as the Corporation becomes under the Act (Sec. 22) Sanitary Authority, and Sec. 85, sub.-sec. (4) provides that the additional salary granted to the Medical Officer of a Dispensary District under Sec. 11 of the Public Health Act, 1878, by reason of his being Medical Officer of Health of the Sanitary District shall be paid by the Council of that Sanitary District. Since the Local Government Act came into force, therefore, he appears to have been a Medical Officer of Health of the Corporation.

Three possible ways in which he might claim superannuation could be suggested:—

(1) Under Section 118 of the Local Government Act, 1898.

(2) Under Section 93 of the Corporation Act, 1890.

(3) Under the Local Officers Superannuation Act, 1869, as amended by the Local Government Act, 1902, Section 10.

Section 118 (1) provides that every existing officer who is transferred to any County or District Council or is an officer of any Board of Guardians, and would if he retired on the appointed day be qualified for superannuation allowance—shall be entitled on resigning to superannuation according to the Civil Service scale, and by sub-section (2) qualified for superannuation means qualified as to age and length of service and devotion of his whole time to the service—except as regards a Medical Officer to whom the Medical Officers Superannuation Act, 1869, applies. Dr. Speedy would not be entitled to superannuation under this Section as he did not devote his whole time to the service, unless the exception of a Medical Officer entitled to superannuation under the Act of 1869 would extend to his position of Medical Officer of Health. If he had not been transferred I think that the Guardians could on his resignation have superannuated him in respect of his position of Medical Officer of Health as well as his other positions, but this would be by virtue of the Act of 1869 and the Public Health Act of 1896, Section 6. Being on the appointed day qualified for superannuation as an officer of the Guardians I am inclined to think that the effect of Section 118 is to make it a right, and that his transfer did not destroy that position but that his right to superannuation was transferred to the Corporation. It is, however, very doubtful and arguable.

Section 93 of the Dublin Corporation Act, 1890, in terms empowers the Corporation on the resignation of a Medical Officer of Health of the Corporation with the sanction of the Local Government Board, to superannuate him. Of course, at the date of the passing of that Act the cases of Officers like Dr. Speedy

were not in contemplation, but the terms of the Act expressly apply to him, and I think that there is power under it to superannuate him. The difficulty, however, would be as to the basis of superannuation, for he was only Medical Officer of Health for a very short time, and there is a serious question whether if superannuation were to be given under this Section his services under the Guardians could be taken into account. This depends upon whether the provision in Section 115 sub-section 3 of the Local Government Act, 1898, can be applied to superannuation of an officer under the Corporation Act of 1890, as to which see below.

The third possible method is under the Local Officers Superannuation Act, 1869, as amended by the Local Government Act, 1902, Sec. 10.

This power, however, seems only to enable the Corporation to superannuate them in respect of their service under the Corporation, and would not enable the Corporation to award an allowance based on the 25 years' service of Dr. Speedy, 20 of which were not in their service, unless the provisions of Sect. 115, sub-sec. (3) of the Act of 1898 apply to such a case. There is a provision in Section 115, sub-section 3, of the Local Government Act, 1898, to the effect that "for the purpose of the enactments relating to superannuation the service of an existing officer of any authority before the transfer to a County or District Council shall be reckoned as service under that Council." If this were to be regarded as a general provision applicable to all existing officers who are expressly or indirectly by the effect of the Act transferred to a County Council, then it would, I think, apply to the powers of superannuation given under Section 93 of the Corporation Act, 1890, and by the Local Officers Superannuation Act, 1869. The provision, however, though very general in its terms, occurs in a sub-section of a section which transfers expressly certain existing officers of a limited class, namely, those who have been employed solely in the business of the authority from whom they are transferred—and it can fairly be contended that sub-section (3) deals only with the officers transferred by sub-section (1) which would not include Dr. Speedy. The words are, however, very wide, and I think that as there is no similar provision in relation to other Officers to whom the same principle must be applicable, the provision would be held to apply to all persons coming under the definition of existing officers and to all enactments relating to their superannuation.

On the whole, therefore, I am of opinion that in each of the three ways above mentioned there is power to superannuate Dr. Speedy for his services as Medical Officer, though as has been seen there are difficulties which may be raised in each case. Under the Local Officers Act, 1869, also the exercise of the power appears to be more optional than under the other powers.

SANITARY ORDER BY LOCAL GOVERNMENT BOARD.

14. The following shall be the duties of the Medical Superintendent Officers of Health in the County Boroughs of Dublin and Belfast:—

> (1.) He shall inform himself respecting all influences affecting or threatening to affect injuriously the public health within the County Borough.
>
> (2.) He shall inquire into and ascertain by such means as are at his disposal, the causes, origin, and distribution of diseases within the County Borough, and ascertain to what extent the same have depended on conditions capable of removal or mitigation,

(3.) He shall by inspection of the County Borough both systematically at certain periods, and at intervals as occasion may require, keep himself informed of the conditions injurious to health existing therein and regularly report the same to the Sanitary Authority.

(4.) He shall advise the Sanitary Authority or their Committees on all matters affecting the health of the County Borough, and on all sanitary points involved in the action of the Sanitary Authority, and in cases requiring it, he shall certify for the guidance of the Sanitary Authority or of the Justices as to any matter in respect to which the Certificate of a Medical Officer of Health or a Medical Practitioner is required as the basis of or in aid of sanitary action.

(5.) He shall advise the Sanitary Authority on any question relating to health involved in the framing and subsequent working of such bye-laws and regulations as they may have power to make, and as to the desirability of the Sanitary Authority adopting any of the provisions of the Public Health Acts or any other Act applicable to Urban Sanitary Districts which it may be optional with the Sanitary Authority to put in force in the County Borough.

(6.) On receiving information of the outbreak of any infectious or epidemic disease of a dangerous character within the County Borough, he shall visit without delay the place where the outbreak has occurred, and inquire into the causes and circumstances of such outbreak, and in case he is not satisfied that all due precautions are being taken, he shall direct the persons competent to act as to the measures which may appear to him to be required to prevent the extension of the disease and take or direct to be taken such measures for the prevention of the spread of the disease as he is legally authorized to take or direct to be taken.

(7.) He shall attend all meetings of the Public Health Committee and advise them as regards the action to be taken in matters relating to sanitation, and he shall also attend all important sanitary prosecutions.

(8.) He shall direct or superintend the work of the Medical Officers of Health and Sanitary Sub-Officers, and on receiving information from such Officers that his intervention is required in consequence of the existence of any nuisance or other conditions injurious to health, or of any overcrowding in a house, he shall, as early as practicable, visit the place and take, or direct to be taken, such steps as he is legally authorized to take, or direct to be taken, and as the circumstances of the case may justify and require.

(9.) In any case in which it may appear to him to be necessary or advisable, or in which he shall be so directed by the Sanitary Authority, he shall himself inspect and examine any animal, carcase, meat, poultry, game, flesh, fish, fruit, vegetables, corn, bread, flour, or milk, or any other article to which the provisions of the Public Health Acts in this behalf apply, exposed for sale or deposited for the purpose of sale or of preparation for sale, and intended for the food of man, which is deemed to be diseased, or unsound, or unwholesome, or unfit for the food of man; and if he finds that such animal or article is diseased, or unsound, or unwholesome, or unfit for the food of man, he shall give such directions as may be necessary for causing the same to be dealt with by a Justice according to the provisions of the Statutes applicable to the case.

(10.) He shall perform all the duties imposed upon him by any of the bye-laws and regulations of the Sanitary Authority, duly confirmed where

confirmation is legally required in respect of any matter affecting the public health, and touching which they are authorized to frame bye-laws and regulations.

(11.) He shall inquire into any offensive process or trade carried on within the County Borough, and report on the appropriate means for the prevention of any nuisance or injury to health therefrom.

(12.) He shall report in writing, monthly, or more frequently if required, to the Sanitary Authority, his proceedings and the measures which may require to be adopted for the improvement or protection of the public health in the County Borough. He shall in like manner report with respect to the sickness and mortality within the County Borough so far as he has been enabled to ascertain the same, and on the discharge of their duties by the Medical Officers of Health and Sanitary Sub-Officers of the County Borough.

(13.) He shall also make an annual report to the Sanitary Authority up to the end of December in each year, comprising a summary of the action taken or which he has advised the Sanitary Authority to take during the year for preventing the spread of disease, and an account of the sanitary state of the County Borough generally at the end of the year. The report shall also contain an account of the inquiries which he has made as to conditions injurious to health existing in the County Borough, and of the proceedings in which he has taken part or advised under any Statute so far as such proceedings relate to those conditions, and also on account of the supervision exercised by him or on his advice for sanitary purposes over places and houses that the Sanitary Authority have power to regulate, with the nature and results of any proceedings which may have been so required and taken in respect of the same during the year. The report shall also record the action taken by him or on his advice during the year in regard to offensive trades, to dairies, cowsheds, and milkshops, and to factories and workshops.

(14.) He shall give immediate information to Us of any outbreak of dangerous epidemic disease within the County Borough, and shall transmit to Us a copy of each annual report and of any special report.

(15.) He shall receive and take the necessary action upon the notices given under the Infectious Disease (Notification) Act, 1889, and in all action taken by the Sanitary Authority under the Infectious Disease (Notification) Act, 1889, and the Infectious Disease (Prevention) Act, 1890, he shall be substituted for the Medical Officer of the Dispensary District in accordance with the provisions of Section 18 of the Public Health (Ireland) Act, 1896.

(16.) When a Certificate has been received from a Medical Practitioner in terms of Section 3 (1) (b) of the Infectious Disease (Notification) Act, 1889, the Medical Superintendent Officer of Health shall instruct the Sanitary Sub-Officer to make the necessary inquiries, and to take such measures as are necessary for preventing the spread of the disease.

(17.) It shall be the duty of the Medical Superintendent Officer of Health to enter, or cause to be entered, both the Certificates and the Notices in a book to be provided by the Sanitary Authority and to be called the *Register of Notifications*, which shall be kept in the Office of the Sanitary Authority for that purpose.

(18.) The Medical Superintendent Officer of Health shall also keep any other books or forms in connexion with the Infectious Disease

(Notification) Act, 1899, which We or the Sanitary Authority may, from time to time, consider necessary.

(19.) Whenever We shall make arrangements for all or any of the purposes specified in Section 149 of the Public Health (Ireland) Act, 1878, and shall declare the regulations so made to be in force within any area comprising the whole or any part of the County Borough, he shall observe such regulations so far as the same relate to or concern his office.

(20.) He shall furnish to Us such returns of sickness and disease as shall from time to time be required from him.

(21.) In matters not specially provided for in this Order, he shall observe and execute all the lawful orders and directions of the Sanitary Authority and all the orders, directions, and instructions that We may hereafter make, issue, or give, applicable to his office.

15. The following shall be the duties of each of the Medical Officers of Health appointed in the County Boroughs of Dublin and Belfast:—

(1.) He shall inform himself respecting all influences affecting or threatening to affect injuriously the public health within his District.

(2.) He shall inquire into and ascertain, by such means as are at his disposal, the causes, origin, and distribution of diseases within his District, and ascertain to what extent the same have depended on conditions capable of removal or mitigation.

(3.) He shall, by inspection of his District both systematically at certain periods and at intervals as occasion may require, keep himself informed of the conditions injurious to health existing therein, and regularly report the same to the Sanitary Authority.

(4.) He shall advise the Sanitary Authority on all matters affecting the health of his District, and on all sanitary points involved in the action of the Sanitary Authority, and in cases requiring it he shall certify, for the guidance of the Sanitary Authority or of the Justices, as to any matter in respect of which the Certificate of a Medical Officer of Health or a Medical Practitioner is required as the basis of or in aid of sanitary action.

(5.) On receiving information of the occurrence of any case of infectious or epidemic disease of a dangerous character within his District, he shall visit the place without delay where the outbreak has occurred and inquire into the causes and circumstances of such outbreak, and report the same to the Medical Superintendent Officer of Health. In case he is not satisfied that all due precautions are being taken, he shall advise the persons competent to act as to the measures which may appear to him to be required to prevent the extension of the disease, and take or direct to be taken such measures for the prevention of the spread of the disease as he is legally authorized to take or direct to be taken. He shall also forward to Us without delay a report giving particulars as to (1) name, age, and address of patient, (2) nature of disease, (3) probable source of infection, and (4) action taken to prevent the spread of the disease; provided always that in the event of an infectious disease becoming epidemic it shall not be necessary for him to report to Us respecting each case as it arises if he has already informed Us of the prevalence of the disease.

(6.) He shall perform all the duties imposed upon him by any bye-laws and regulations of the Sanitary Authority, duly confirmed where confirmation is legally required, in respect to any matter affecting the public health and touching which they are authorized to frame bye-laws and regulations.

(7.) He shall inquire into any offensive process or trade carried on within his District, and report on the appropriate means for the prevention of any nuisance or injury to health therefrom.

(8.) He shall attend all such meetings of the Public Health Committee as they may direct, and shall assist in all proceedings in which his services may be required.

(9.) He shall from time to time report, in writing, to the Sanitary Authority his proceedings and the measures which he may require to be adopted for the improvement or protection of the public health in his District.

(10.) He shall keep a book or books, to be provided by the Sanitary Authority, in which he shall make an entry of his visits, and notes of his observations and instructions thereon, and also the date and nature of applications made to him, the date and result of the action taken thereon, and of any action taken on previous reports, and shall produce such book or books whenever required to do so by the Sanitary Authority.

(11.) Whenever We shall make regulations for all or any of the purposes specified in Section 149 of the Public Health (Ireland) Act, 1878, and shall declare the regulations so made to be in force within any area comprising the whole or any part of his District, he shall observe such regulations so far as the same relate to or concern his office.

(12.) He shall furnish Us with such returns of sickness and disease as shall from time to time be required from him.

(13.) In matters not specifically provided for in this Order, he shall observe and execute all the lawful orders and directions of the Sanitary Authority and all the orders, directions, and instructions that We may hereafter make, issue, or give, applicable to his office.

16. The following shall be the duties of each Executive Sanitary Officer of the County Boroughs of Dublin and Belfast:—

(1.) He shall attend all meetings of the Public Health Committee, and take their directions from time to time on the sanitary business of the County Borough, and on the reports of the Sanitary Officers and all proceedings arising thereon, and shall, so far as may be requisite, give instructions for the prompt and correct execution of all such orders and directions, and report on such execution or any neglect or failure therein which may come to his knowledge.

(2.) He shall report to the Public Health Committee at each meeting any failure on the part of the Sanitary Sub-Officers to comply with the provisions of Article 17 (10) of this Order, and any neglect by a Sanitary Officer to carry out the duties of his office as herein prescribed.

(3.) He shall keep a record of the proceedings of the Public Health Committee at their several meetings, and shall transmit a copy of such record to Us as soon after each meeting as practicable.

(4.) He shall report forthwith to the Medical Officer of Health the action taken by the Sanitary Authority on the reports submitted to them by that Officer.

(5.) In matters not specifically provided for in this Order, he shall obey and execute all the lawful orders and directions of the Sanitary Authority, and all the orders, directions, and instructions that We may hereafter make, issue, or give, applicable to his office.

CONGRESS AT GLASGOW.

CONFERENCE OF ENGINEERS AND SURVEYORS TO COUNTY AND OTHER SANITARY AUTHORITIES.

ADDRESS

By WILLIAM WEAVER, M.Inst.C.E.,
Borough Engineer, Kensington; President of the Incorporated Association of Municipal and County Engineers.

PRESIDENT OF THE CONFERENCE.

IN part recognition of the honour conferred in appointing me President of this section of the Congress, it is my duty and pleasure to offer a few remarks pertinent to the objects of this meeting.

The aim of The Sanitary Institute is to promote the advancement of sanitary science, and to diffuse knowledge relating thereto, and without doubt municipal engineers form an important factor in the advancement of the aforesaid aim of the Institute, and doubtless the papers about to be read will furnish evidence in this direction.

Sanitary science covers a much wider area than the suppression of nuisances; it embraces everything which tends to the physical and mental improvement of the nation, and so complex and interwoven are the issues of national life, that great care must be exercised in pushing reforms in one direction, in order that the good thereby achieved is not outweighed by the reflex action set up in other directions.

In a paper which I read in this building in September, 1901, I alluded to the partiality of sanitary effort for property only, leaving the insanitary individual untouched, free to stalk about and multiply broadcast, to the detriment of the community.

Since submitting the said remarks, one phase of the question has been taken up by the newspapers under the heading of "Pests in the Parks," with the result that the nuisance is, to some extent, kept moving; thus involving greater diffusion.

The good, old-fashioned "pass it on" doctrine will never successfully cope with the evil, and until sanitary legislation is made applicable to the individual, instead of being almost solely limited to property, national decadence must perforce proceed.

The great stumbling-block in the way of real reform is the religious sentiment as to the sanctity of human life; and although this sentiment is apt to be ruthlessly disturbed in time of war, when men in their thousands are ordered forward to certain death, such sacrifice is justified on national grounds, but at the present time such justification is not permitted to extend to the elimination of the unfit: on the contrary, every effort is in the direction of fostering the human failures, to the detriment of the standard of national vitality.

The mentally and physically totally unfit are allowed perfect freedom to breed broadcast, and it is quite within the range of possibility that at no very distant date, the incapables in public buildings will attain a percentage of population beyond the maintenance efforts of the outside workers.

In my opinion, it is in this direction that the preventive efforts of sanitary science should be directed, so that the proper breeding of the nation may receive equal attention as their housing, and the physical improvement of the masses may keep pace with the sanitary improvement of their dwellings.

Under the present law, any house which becomes dangerous or dilapidated to the menace of its neighbours can be demolished, but apart from notifiable diseases, the legislative protection of the community versus the individual is almost solely directed against acts of violence.

Sanitation should apply to the individual as well as to his dwelling, and without doubt cleanliness would materially tend to promote sobriety, the lack of which is responsible for nearly the whole of the mental and physical ills affecting the community. Incidentally, I hold a strong view that it is almost impossible for anyone taking a cold bath early every morning to become an habitual drunkard; the two habits are inconsistent.

Advanced civilization sows the seed of its own decadence by its involved concentration of population, and I am of opinion that no weightier subject can engage the attention of sanitary scientists than the best means to be adopted in maintaining the physical and mental standard of the race, for upon that standard depends the future of our country.

CONGRESS AT GLASGOW.

CONFERENCE OF VETERINARY INSPECTORS.

ADDRESS

By Prof. JAMES McCALL, F.R.C.V.S.,

Principal, Glasgow Veterinary College.

PRESIDENT OF THE CONFERENCE.

MY first and a very pleasing duty it is, is to welcome you to this, the Twenty-second Congress, now held under the auspices of The Sanitary Institute.

True it is, that it has only been during the last few years that a special section of this great Congress has been devoted to a Conference of Veterinary Officers of Health; but from what I have observed I feel warranted in prognosticating that it will not be the least important section, and as time rolls on it is bound to prove more and more its utility and importance.

Judging from the apathy displayed by the Government of this country and the general public, it would appear as if the diseases of the lower animals were so few and trivial, so easily diagnosed and eradicated, so dis-associated from those of the higher animal, man, that no government supervision or pecuniary aid was required to be expended in the education and training of the veterinary student.

Now I do not require to tell you that the diseases afflicting the lower animals are neither few nor trivial. They are as numerous as those affecting the human subject, and for obvious reasons much more difficult to diagnose; and, as regards their communicability, many of them are not only easily transmitted to man, but are quite as destructive of health and life in his case as in theirs.

Not only so, but some of the most loathsome and deadly diseases which afflict mankind would cease to attack him if they had not a prior stage of existence in the lower animals. As an example of this, I may mention

glanders, anthrax, rabies, certain internal and external parasitic diseases, and, in all probability, tuberculosis.

For these, and many other reasons which might be stated did time permit, I trust that the day is not far distant when the Government of this country, as in all continental countries of any note, will bring about an affiliation of the veterinary colleges with the medical colleges, and by a judicious expenditure of public money, will see that the education and training of the medical and veterinary student is alike liberal and efficient.

Such a consummation should have the support of every well-wisher of his country, for it would in time not only lead to a greater relief of pain and suffering in the higher and lower animals alike, but it would, as I have already stated, finally result in the stamping out of some of the most deadly diseases which at the present time afflict both.

My province, as I understand it, is more to preside over your deliberations than to introduce a subject or subjects for your discussion, so I will only take the liberty of placing before you one subject, and that is the housing or stabling of horses in towns and cities. As you are no doubt well aware, the housing of cattle, and more especially of dairy-cows, is regulated by "The Dairies Cowsheds and Milk Shops Order of 1885"; then under the Public Health (Scotland) Act, 1897, provision is made for the housing of pigs, and I think I am warranted in saying that ample provision has been made for securing for these animals all the creature comforts which they require. In fact, no building will be licensed as a cowshed or piggery, unless its construction, ventilation, drainage, and surroundings conform to certain definite specifications. But I regret to say that the Board of Agriculture have issued no order dealing with stables, and the consequence is that, in this city as well as in other large towns, many horses are stabled in hovels which are a disgrace to humanity, and in which no living creature should be allowed to reside.

I could take you to stables in this city, underground and aboveground, in which there is neither a window nor a ventilator nor a floor except the sodden foul-smelling earth, and in the same place and under the same roof, the dung is allowed to accumulate for weeks, and a stall is made to do duty for a dung pit.

The Local Authority of Glasgow, for whom I act as inspector under the Contagious Diseases (Animals) Act, have for years again and again brought this subject under the notice of the Board of Agriculture, and pressed them to pass an order, giving local authorities the power of licensing stables, but as yet without effect. It is well known

that Government departments seldom initiate reforms which involve greater responsibilities, and knowing this and seeing the Board have turned a deaf ear to the solicitations of the local authorities to have stables licensed as well as cattle-sheds, I have taken this opportunity of bringing the subject under the notice of this influential Congress.

I have no desire to circulate the opinion that glanders, a disease which annually destroys a large number of horses in London, Glasgow, and other cities, and which claims as its victim now and again the keeper of the affected animal, can originate from defective hygienic conditions; but I know that when once the disease claims a victim under such conditions, it is but a matter of time until the whole stud becomes afflicted. As an example of this and the rapidity with which the whole stud may become affected, I will briefly refer to an outbreak of glanders which came under my notice a few weeks ago. The stud consisted of eight cart horses, and they were housed under a broad railway arch. The heads of the horses ranged along the dead wall, so that the atmospheric air which entered the arch from either side was vitiated before it passed any length across the arch, and the horses in the centre breathed nothing but foul air. The walls were damp, in fact water was exuding from and running down the walls, it was dripping on their backs, and pools of it filled holes in the floor, and when the animals lay down, their bodies rested in it. The floor was coated thickly with dirt and dung, and worse than all, tons of dung were contained in a corner of the arch, so that the animals were forced to breathe the foul emanations therefrom.

The stall divisions were broken down, and the mangers being continuous the animals fed promiscuously.

The owner, finding that three of his horses were unable to go to work, and that all of them were looking ill, resolved to communicate with me, and having done so, I, as inspector of the local authority, at once visited the stables. On entering the stable I found one of the horses lying dead. Its death had taken place immediately before my arrival, and the cause of death was glanders. Standing alongside the dead horse were two other horses in an emaciated condition, and they also on examination proved to be glandered.

The owner having informed me that the other five horses were out at work, I arranged to return and inspect them on their return from work the same evening. Returning to fulfil my promise I was told that one of the five horses on his way home had fallen in the cart, and that he was unable to rise, and therefore he was slaughtered and removed to the knackery. The remaining four horses, being of little value and in a highly

suspicious state, were at the owner's request slaughtered, and a post-mortem examination of all the five animals demonstrated the existence of glanders nodules in all their lungs.

Now I admit that this, in some respects, is the most malignant outbreak of glanders which has come under my notice, and undoubtedly the damaged grains on which the owner admitted he had fed his horses, and the facilities afforded while feeding together of inoculating each other, largely account for the rapidity of the spread of the disease to all the animals; still, if the construction of the stables, the ventilation, and other hygienic conditions had been such as in the cowsheds under license, then such a catastrophe and sacrifice of animal life and property could not have arisen, and I hold (to put it no higher than in the interests of horse proprietors, and leaving humanity out of the question) that it would be to their direct pecuniary advantage to have all stables in towns licensed.

CONGRESS AT GLASGOW.

CONFERENCE OF SANITARY INSPECTORS.

ADDRESS

By T. F. STRUTT,

Late Chief Sanitary Inspector, City of Westminster.

(Member.)

President of the Conference.

IT gave me very great pleasure to be called upon to preside over the conference of my brother officers in connection with the Congress of The Sanitary Institute, and the pleasure is enhanced when I reflect on the past and note the advances in sanitary science, due to the efforts of the Institute which has been good enough to invite us once again to take part in their Annual Congress of Sanitation in this important City of Glasgow, and I trust that our deliberations may, by the interchange of ideas, prove beneficial to us as inspectors, and stimulate our actions in the cause which we have at heart.

With the general duties of a sanitary officer you are so well acquainted that I will not take up your time in a recapitulation of the multifarious duties we have to perform, but proceed to address you on the questions which are uppermost in our minds and in the mind of every sanitary inspector throughout the United Kingdom, viz., "tenure of office, superannuation, and unity of our forces in the endeavour to obtain an amelioration of the grievances from which we suffer."

I do not believe that if the public knew how oppressive are our grievances and how they hinder sanitary effectiveness, we should any longer suffer from insecurity of tenure in our appointments, because as matters stand at present the unjust conditions under which sanitary inspectors hold their appointments are a standing menace to public health. How can a sanitary inspector be expected to do his duty fearlessly, when

the council which employs him, is, as is commonly the case, composed of tradesmen, slum-property owners, house farmers, the jerry-builders and their friends? So long as he does not molest the vested interests of his employers he may probably hold his appointment in security, but let the inspector prosecute any of his employers for adulteration, or discover defects in the drainage of slum-owners' property, and he is at once a marked man, and may, when the time comes for re-appointment, not be again elected.

Members of Parliament and the press should realise that it is of little use passing Public Health Acts if the hands of those appointed to enforce them are tied, by placing them in a position where they can be terrorised by the very class whose evil deeds they are supposed to prevent.

What sane man would approve of placing the police of the United Kingdom under the jurisdiction of the criminal classes and give them the right of appointing as well as powers of summary dismissal of any policeman of whom they do not approve? Such a state of things would be absurd, yet it is practically paralleled in the case of ourselves. Only the other day, when Mr. Walter Long was waited upon with the reasonable request that a measure should be introduced providing that the health officer should have the right of appeal to the Local Government Board in case of dismissal, he scouted the suggestion, and thought there was no need to interfere with the terms of appointments, and the officer who is appointed for one year ought not to feel aggrieved if the local authority fail to re-elect him for a further term.

I say the present position is not only an intolerable injustice but is against the public welfare; it is the most powerful factor in encouraging adulteration and spreading disease. It ties the hands of zealous officers, and induces them into acquiescence in many things they would otherwise condemn. It is shameful and a disgrace to Parliament that it should turn a deaf ear to our complaint, and afford us no protection for the proper performance of our duties to the public. It is a danger to the public health, and the more zealous we are in seizing unsound food, prosecuting the fraudulent tradesman, and compelling the owner of insanitary property to put his premises into proper sanitary order, the more certain are we of making our appointments insecure. I think the press of the United Kingdom would do well to devote some attention to this serious evil, and afford us its powerful aid in removing such a bar to sanitary efficiency.

Times over we see complaints in the press about adulteration being unchecked, but do those who complain, or who write so fervidly upon the question, realise that adulteration flourishes because it is fostered and pro-

tected by law, and we, the sanitary officers who could suppress it, are at the mercy of those who profit most by wholesale frauds?

In pleading for protection against malevolent and interested opposition to our work and unjust dismissal, I do not ask for the referendum to the Local Government Board for selfish reasons, but on the wider grounds of public benefit.

A Royal Commission has recently proclaimed consumption in men and cattle to be probably an identical disease, and as far as can be demonstrated in these days when experiments as to its communicability from animals to human beings by the flesh or milk are not permitted, the Royal Commission tells us that this devastating disease, tuberculosis, which slays in Great Britain alone nearly 60,000 yearly, is propagated by tuberculous milk and meat. Statistics show that nearly one half of all deaths occurring between the ages of 25 and 35 are due to this disease. In Scotland about 7,150 die from it every year. In England the rate of mortality due to it is 135 per 100,000. The London rate is 177, that of Edinburgh 191, and for the south-western district of Scotland it is 193, the highest north of the Tweed.

Now let us see the price the public pays for not giving the sanitary officer fixity of tenure in his office, for such I hold would be the effect of the right of appeal to the Local Government Board, as we could safely rely on the Board not putting its veto upon the discharge of any officer whose conduct was such as to merit dismissal by the town council or local authority employing him.

I have no means of obtaining the figures of the milk supply for the whole of the United Kingdom, but a very little reflection will convince anyone that the public, in addition to the risk of contracting tuberculosis by infected milk, is defrauded of an enormous sum, possibly a million or more, of money annually, by the present ignorant and unscientific milk legislation.

There is the scientific work of Dr. Veith, Mr. Droop Richmond, and others, based upon the analyses of some 300,000 samples of mixed milk of herds (and it should be borne in mind that the milk supply of large towns is, with few exceptions, the mixed milk of herds) proving that the fat (or cream as the public knows it) is more often nearer four per cent. than three, and seldom falls below three and a half per cent. But what does the law do? It establishes a fraud-fostering standard of three per cent., thus offering a premium to the dishonest dairyman by inviting him to adulterate genuine milk to the debased standard, and it even out-Herods Herod in folly by further covering him with the protection of a warranty, behind

which he can screen himself should the sanitary inspector try to stop his roguish practices. In May and June the fat is usually the lowest, falling to 3·30 per cent. average composition for morning milk, and 3.50 for evening milk, but in the other months it averages $3\frac{3}{4}$ per cent. A very little calculation will show how the dishonest dairyman can and does avail himself of the temptation to fraud. Say for example he takes twenty gallons of mixed herd milk containing $3\frac{3}{4}$ per cent. of fat, he can add to this four gallons of separated milk, having ·10 or so of fat, and one gallon of water to reduce the caseine to due proportions, and out of every twenty gallons he makes twenty-five, thus:

20 gallons pure milk	...	3·75 =	75·00
4 „ skim „	...	·10 =	·40
1 gallon water	...	·00 =	·00
	Divide by 25	... 75·40	... 3·1

Just over three per cent. legalised by the Board of Agriculture. The water used for the adulteration may be pure or not, according to the sanitary condition of the dairy farm. Mr. Rider Haggard has told us from actual observation what those conditions too often are, the water supply being the pond that the animals pollute, covered with slime and swarming with lower animal organisms.

Can we wonder that there is no decline in infantile mortality, that despite all our boasted advance in sanitary perfection, it is as high as it was in the middle of the last century, and averages throughout the whole of England and Wales 154 per 1,000.

I would ask the press and the public if it is in the public interest that the sanitary inspectors, who could do so much to reduce the slaughter of the innocents, should be in the position that the men whom they should prosecute for these frauds have it in their power to dismiss the inspector from his office and ruin him should he dare to assert the right he is supposed to legally possess to protect the public and reduce this terrible death-rate? But Mr. Walter Long is unable to see that we have any grievances, and, like Pangloss, believes "everything is for the best in this best of all possible worlds." Well, I don't. I think that such a death-rate among infants is a disgrace to a civilised country, and if the public and the press understood the bald measure of justice we ask, I am sure we should be accorded forthwith the right of appeal to the Local Government Board in case of dismissal; but government fatuity goes even further in protecting fraud than in sanctioning a three per cent. milk standard, and making the inspector who should suppress adulteration the servant of those who

practise and profit by it. The law provides the dishonest dealer with the protection of the warranty; now, what the effect of the warranty is most of you know by unhappy experience, it practically prevents you doing anything to suppress adulteration. Its absurdity is evident to anyone who has to deal with the milk supplies of large cities, and who knows by experience that a warranty is a hollow imposture out and out. Take the average small milkman who obtains his supply from any of the London milk companies. He wants, say, twenty-five gallons for his customers, the churns are there at the railway station or at the depot, one containing twelve gallons, another fifteen, another fourteen, and so on, all from different farms. The milkman receives fifteen gallons from one and ten from another churn, or perhaps his supply may come from three or four churns, the produce of as many different farms. Now, against whom can any warranty honestly operate in case the milk be afterwards found to be adulterated and not by the retailer. The retailer can plead a warranty, the wholesale dealer can plead it, and the consequence is that never in the memory of sanitary experts has adulteration in milk been so widespread or so impossible of punishment as it is to-day, thanks to the three per cent. standard, the warranty defence, and the fact that the sanitary inspector has no security of tenure of office, and is liable to be thrown over at the annual election for being energetic in doing his duty. I have often heard the magistrate, before whom the retailer is brought for adulteration, advise him to seek the protection of a warranty, and what the quality of the London milk supply will be when the magistrates' advice is adopted by those who have neglected it so far, is horrible to contemplate.

There is another side to this question, and that is its effect upon dairy farming, which is worthy of the attention of those who are concerned with British agriculture. A proper enforcement of the Acts would mean an increase of at least five per cent. or probably ten in the milk consumption, and what this means to the dairy farming interest is obvious.

When I ask for fixity of tenure in their appointments for sanitary inspectors, I do so because I am firmly convinced that it is necessary in the public interest.

The medical officers of health in London have it, and in the provinces they enjoy some security, but they are not the persons who have to do the sanitary work. Some merely take the inspector's report and too often the credit for any meritorious work when it is accomplished. I do not complain that the medical officers have fixity of tenure, but I do say the sanitary inspector stands in far sorer need of this protection, because to him dismissal too often means ruin, but to the medical officer it means

nothing of the kind, he has his profession and can return to general practice, whereas the sanitary inspector has no chance of further employment if over a certain age, or if those who dismiss him have a grudge against him, for they are under no obligation to give him a character.

It may seem a strong thing to say, but I am certain that the health of the people of the United Kingdom depends more than most sanitary experts imagine upon the protection which the sanitary inspector asks for.

Take, for example, the finding of the Royal Commission that tuberculosis is communicable to man by the flesh of animals as well as by their milk. Every experienced inspector knows that the position of the butcher is an anomalous one, probably because like the sanitary inspector he has no powerful parliamentary representation and consequently but few friends in the legislative house. The butcher who buys two or three beasts has no means of knowing if they are afflicted with tuberculosis, and as his purchase may often absorb all his trading capital, it is hard lines for him should they be found on being killed to be tuberculous. He cannot recover the money from the cattle dealer, and his temptation is strong to take the risk of selling the meat which until lately so many scientists would scarcely pronounce definitely as dangerous to health. Prof. Macfadyen applied the tuberculin test to her late Majesty's herd at the home farm, and found that thirty-six out of the forty animals were attacked by the disease, albeit, as he instanced, these animals were probably the best housed in the kingdom from the point of view of cubic space, light, ventilation, and cleanliness. That there is an enormous amount of tuberculosis among cattle is beyond dispute, and the report of the Royal Commission must inevitably result in more stringent measures being taken to prevent tuberculous meat being sold to the public. What the butchers will do to protect themselves, whether by insurance or warranties, is not a matter within the province of this address, but it is obvious that the sanitary inspector will be looked to to exercise great vigilance against possible tuberculous meat and milk. I could give reasons innumerable why you should have fixity of tenure in your appointments, but I think the few I have adduced should be sufficient to convince the press, the public, and members of Parliament. The public welfare demands that our claim should be promptly conceded.

I am glad to say, with some confidence, that the movement for justice to sanitary inspectors is progressing, if not by leaps and bounds, yet sensibly, for we have seen in recent issues of some daily papers that the

absurdity of our present insecure position is being recognised by the public as a danger.

But are we doing enough ourselves to educate the public, and above all that most important part of it, the members of Parliament, upon the question. I am afraid not, and one of the main drawbacks has been the want of unity. We all know the wise fable of Æsop about the bundle of sticks, and I know of no reason why the whole of the sanitary inspectors of the United Kingdom should not be members of one association, working earnestly for justice to sanitary inspectors, and greater sanitary efficiency; and why there should be more than one association has always been a puzzle, and a lamentable one, to me, because our energies are more or less wasted by the absence of co-ordinated effort.

I am convinced that if we would resolve to unite and agitate for fair play for sanitary inspectors, and persistently bring our grievances to the notice of the press, the public, and Parliament, we should be able to secure fixity of tenure in our appointments and superannuation.

I know of no body of men in the service of the public whose claims are more incontestable. The soldier may have years of peace ere he risks his life in the horrors of war, but the sanitary inspector must ever take the risk of disease and death, fearlessly doing his duty to the public, by entering the foul places of the earth, purifying and making them wholesome, fighting the demons of small-pox or of fever, battling against the powerful and malign influences of the slum-property owner, the house-farmer, the jerry-builder, and others, who in some form or other make money out of slums, overcrowded dwellings, or adulterated or unwholesome food. I am sure that were we united, and were we to use all our powers and explain fully and persistently to the press and the members of the Houses of Parliament how injurious to the public welfare is our present system of tenure of office, we should soon get from Parliament the right of appeal to the Local Government Board against dismissal from office. There are many of us who are acquainted with members of Parliament, and I can say from personal experience that the bulk of them are not aware that we are liable to dismissal by the town council or other authority who employs us, without an appeal against that dismissal, however unjust or malevolent it may be, or if it be engineered by some slum-property owner whose drains we have found necessary to condemn, or some grocer or milkman whom we have prosecuted for adulteration. But we must speak with one voice and one effort to influence members of the House of Commons, and to obtain the ear of the public through the press

must be the well thought out policy of a council, speaking with full authority for every sanitary inspector in the kingdom. Our policy, to paraphrase Danton, should be "Unity, Unity, and, above all, Unity," for there lies our strength. My own opinion is that whenever Parliament is sitting, no opportunity should pass without some member of our association being in the lobby of the House of Commons and seeing the member of Parliament for his division, explaining our grievances and the reasonableness of our demands; we should have not one, but half a dozen measures drafted and taken up by different members of Parliament, so that if one fails to secure a place in the balloting, another may not, and we should, in season and out of season, bombard the press with letters, secure interviews, etc., until the real nature of the peril to the public, our insecurity of office, is made clear. In other words, I advocate a policy of enlightened and persistent agitation by a united body of the sanitary officers of the United Kingdom.

I have been asked to say a few words anent a Government Department of Public Health. Well, a dream that every one of us would wish to see become a reality is a Ministry of Public Health; but in advocating this very vital reform let us take warning from the fate of others, who have expended their energies in securing ministers for special departments, and, having obtained their wishes, have found out that they gained nothing.

I am as anxious as any man living to see a British Ministry of Public Health, but I do not want one fashioned upon political lines, governed by a party chief ignorant of practical public health science and problems. Far better, I say, to be without one, unless its head be a practical public health expert, such as Sir James Crichton-Browne, Sir Michael Foster, Sir Walter Foster, or like men, who have achieved distinction in their professional work as well as socially and politically; and in our advocacy of this very much needed department we should never lose sight of the fact that unless it be manned by experts in each branch of sanitary science, it would be a humbug and probably a curse.

To a Ministry of *real experts* the questions of examinations for sanitary diplomas, of the relative duties of medical officers of health and inspectors, of a referendum in case of disagreement by the local authorities, and of special regulations for noxious and dangerous trades, etc., could safely be left.

In conclusion let me express the deep debt of gratitude every sanitary inspector, and I may say the whole of the public, owes to The Sanitary Institute for its sterling service to the people in organising and ensuring efficiency in public health work. The Sanitary Institute was the first to

recognise the necessity of special training for sanitary inspectors, and carried this into effect by organising lectures, demonstrations in sanitary science, the holding of examinations, and the granting of a certificate in sanitary knowledge. What inspector has not felt himself richer by the possession of that diploma? The Institute has done much to raise the status of the sanitary inspector, and I feel that I am speaking on behalf of the sanitary officers of the United Kingdom in thus expressing our gratitude.

What a Government Department ought to have done but has not, The Sanitary Institute has done with a thoroughness and devotion which no words of mine can sufficiently praise. The Institute has raised the standard of sanitary science and sanitary officers, and can honestly claim to have been a most potent factor in achieving the diminution of the death-rate and of sickness, which means the saving of many thousands of lives, and hundreds of thousands of pounds of money every year to the nation. From my heart I say that The Sanitary Institute is an institution of which every inhabitant of the British Isles has every cause to feel proud, and that it may long continue its honoured and glorious career of public service and usefulness is, I am sure, the sincere wish of everyone concerned with public health work.

CONGRESS AT GLASGOW.

CONFERENCE OF WOMEN ON HYGIENE.

ADDRESS

By Her Grace the DUCHESS OF MONTROSE.

PRESIDENT OF THE CONFERENCE.

IT is with the greatest diffidence that I rise to say a few words at the commencement of our proceedings to-day, as I am fully conscious that many others here are far better qualified than myself to address you on this all-important and far-reaching subject of hygiene.

The only qualification I can lay claim to for occupying this chair is my great interest in the subjects to be discussed, and my belief that women can be of special service in promoting and encouraging the advancement of hygienic knowledge.

There is no doubt that education during the last thirty years has made huge strides, and that many advanced subjects are now taught in Board schools which to a former generation were unknown; but when so much is heard of physical degeneration amongst the poorer classes, doubts must arise as to whether the practical side of education is sufficiently considered.

Is there not something wanting in our educational system, if ignorance prevails in that most necessary branch of technical education, the technic or art of keeping oneself in health? Assuming that physical degeneration results in a great measure from causes which are preventable, namely, to neglect of the laws of health, to the evil effects of overcrowding, unsuitable food badly cooked, sleeping in unventilated rooms, it is manifestly important that the science of health, which is too often neglected in our curriculum of so-called education, should be taught—the rudiments of it, at least—in every school and college.

Why should not every child in our Board schools be taught the value of fresh air, pure water, wholesome food, and all that relates to a condition of health, and on the other hand all that tends to create disease? We might anticipate great results therefrom in the next generation.

It is appalling to see the number of city children who suffer from sore eyes, bad teeth, and rickety bones, yet this deplorable state of things might be combated if parents understood more about health conditions and wholesome diet. Is there anyone, man or woman, who would not be better and happier with such useful knowledge, on which depends his own well-being and the well-being of his children?

No doubt the public mind is gradually awakening to the importance of physical instruction for the future men and women of the country, and probably in many schools such instruction is now being given; but much remains still to be done, and the teachers themselves need more physiological and health knowledge to enable them to carry out the teaching in a practical and efficient way.

For these questions relating to the science of health are questions which call for the attention not of statesmen and medical men only, but of every father and mother in the land.

Those who will have all the responsibilities of motherhood ten years hence are now in the schools, and can be taught the vital importance of these matters, on which the health of the next generation will depend.

We hear on all sides of the urgent need there is at the present time for fresh air homes for the cure of those in the first stages of consumption, but there is little doubt, if the essential principles of health which render these fresh air homes so salutary were carried out to some extent in the cottages of the working classes, especially fresh air by night as well as by day, the necessity for these homes might cease to exist.

Another important matter which receives far too little attention in school life is the physical development of girls.

It is distressing to see amongst girls of the poorer classes the round stooping shoulders and narrow chests, which are so prevalent. Yet how much might be done by physical exercises of all kinds in school—and suitable loose clothing worn to permit the chests and lungs of growing girls to develop, if only the importance of this were realised.

Efforts are also needed to counteract the tendency which prevails amongst young country girls of the present day to rush for employment to towns and cities, seeking occupations there for which they are often physically unfit, and setting no value on the sound practical training they could obtain in useful household duties, which would fit them to become good wives and wise mothers.

A great responsibility rests upon women to further these objects. In past generations women erred in these matters through ignorance, but medical science in these days has so advanced that we can no longer plead

that excuse, and as woman's sphere of influence is now so much enlarged so has her responsibility increased.

Interest has awakened in all these subjects, and women have it in their power to do lasting good if they will but exert the vast influence they undoubtedly possess in ameliorating the condition of the poorer classes.

The good work accomplished through the medium of The Sanitary Institute in recent years is to throw valuable light on these important questions, health and sanitation, and that light, we can thankfully say, is widening and deepening steadily.

I know that many here to-day are actively engaged in most useful work for the betterment of the working classes, and I trust the discussion of the numerous interesting papers on the list before us may further the object we all have in view, which is for each of us to aid this work to the best of our ability; work which will tend to improve the health and well-being of the poorer classes of the community in the next generation.

CONGRESS AT GLASGOW.

CONFERENCE ON THE HYGIENE OF SCHOOL LIFE.

ADDRESS

By Prof. JOHN EDGAR, M.A.,

Professor of Education, St. Andrews University.

PRESIDENT OF THE CONFERENCE.

HYGIENE AND THE TEACHER.

THIS important conference on School Hygiene is one of many signs of the great expansion which is everywhere taking place in modern ideas of the scope of education and the function of the teacher.

Gradually but surely the belief is gaining ground that school is a preparation for life; and not only a preparation, but a real and important part of life. It is now being recognised that the teacher is more than an instructor in reading, writing, and arithmetic, in classics and mathematics. He is an important factor in the highest of biological processes, and in social evolution. For education, in biological terms, is the adjustment or adaptation of a growing human being to his environment. With the evolution of society that process is growing in complexity. And it is the teacher who must, in the light of experience and science, direct a considerable part of this process.

The environment of the child is partly physical and partly spiritual. Neither side can be safely neglected. The education of the future must take account of both, and must realise that the two sides are intimately connected.

Education may now profit, and is indeed beginning to profit, by the fruitful labours of science. In the fields of Biology, Physiology, Hygiene, and Psychology, earnest workers have in the last generation added enormously to our knowledge of body and mind, and of the laws of health. Educational thinkers are setting themselves to find out the practical

bearing of scientific discovery upon the guidance of human growth. A new conception of the meaning of education and the teacher's work is taking shape. This new conception is based upon our increasing knowledge of the human organism, of the laws of its working, of the conditions of its healthy life and growth, and upon the application to human life of the principle of evolution.

"Sound educational theory to-day," writes Prof. Nicholas Murray Butler, "finds no place for any mental training which overlooks the relation of mind and body and its hygienic and ethical import. It is not too much to say that health, its provision and protection, is all-controlling in present-day educational theory, although it is unfortunately far from being so in practice. The chief reason for this discrepancy between the ideal and the real is simple ignorance."

But this ignorance is now doomed. For a while the protests of enlightened medical men, like Sir James Crichton-Browne and others, were as voices crying in the wilderness. But their protests reached the ear of our Education Departments, and the public schools of the country have been more and more modelled on hygienic lines, and increasing attention has been paid to healthier conditions of work and to the spread of hygienic knowledge. The Royal Commission on Physical Training (Scotland) laid down as the first principle of a national system that "physical training should be regarded as of equal importance with mental training." And the Inter-Departmental Committee on the Model Course of Physical Exercises, in their admirable report recently issued, carry this principle a step further. "It has been forced upon the Committee, in the course of their deliberations, that important as the question of physical exercises for schools is in itself, it is only *part of a much larger question*, viz., that of school and personal hygiene." "The construction of a suitable course of exercise is conditioned throughout by considerations relating to the health of the children." This report will, I hope, be placed in the hands of every teacher; and it deserves, and will repay, the most careful study. It is at once scientific and practical, and should do much to promote our physical welfare. Let me quote with the heartiest approval the following passage from Section 9: "As regards future teachers, we suggest that suitable instruction in the laws of health and in the outward signs of physical and mental weakness should receive a much more prominent place in the scheme for the training of teachers than appears to have been the case hitherto. For this purpose no mere bookwork instruction, such as may be necessary for passing written examinations in physiology and hygiene, is sufficient. The instruction should include a certain amount of,

so to speak, clinical experience. The students should be made acquainted practically with the indications of normal health and normal physique, and taught how to recognise probable deviations from this standard. They should be able to recognise such signs of defective nutrition, and such defects of sight, hearing and breathing, as require medical attention. They should also be familiar with the signs of fatigue, physical or mental, which to the experienced teacher are the gauge on which he keeps his eye in regulating the work of a class."

The teacher must indeed have a thorough knowledge of subjects of instruction; but if he is to be an educator as well as an instructor, capable of guiding the growth of each individual pupil towards his highest social fitness, or of scientifically directing his process of adjustment, he must know in addition, and know theoretically and practically, (1) the nature of the growing organism, the child, (2) the physical environment best suited to its health and growth. This combined knowledge may be called hygienic physiology, but is what I personally understand by school hygiene. Such knowledge I consider necessary in some degree for every teacher, and it will, I hope, become a fundamental part of his future professional outfit or equipment.

Whether the teacher be head master or assistant master, special master or class master, he requires this knowledge for his pupils' sake, for his work's sake, and for the country's sake. He will find it also useful for his own sake. For one of the most important factors in education is the personal influence of the teacher himself. The teacher is his own chief instrument. He should know, therefore, in what conditions he can work best, when he is most and least effective, and so arrange and divide his work as to take full advantage of his own power and energies, and utilise in the best and most economical way his own chief instrument.

Education has now become a great national concern, and constitutes, when properly understood in its wide sense, the greatest of national interests. The introduction of hygienic physiology into the sphere of the school means that science and enlightened experience are now to take their proper place in education, that mind is to aid more deliberately in the evolution of the nation and the race. The teacher should be the practical expert in the guidance of growth towards the highest possible for each individual. He should go forward to his task equipped with the fullest knowledge which science can give him of the physical nature of the child, of individual variations, and of the laws of growth. Like an artist he must have an ideal and a method, but he must also know his material, and the conditions in which it is best moulded.

Science has recently made great progress towards a thorough understanding of the most favourable environment for the healthy growth of all children. Growth, we know, is dependent on the one hand on the vital energy in the body, and on the other on the supply of food, light, air, heat, and on the proper alternation of movement and rest. It proceeds usually on certain general normal lines. But no two children are quite alike, and deviations from the normal are exceedingly common. What is the best course for one child, may be positively harmful to another. Science is able to give assistance with the individual peculiarities as well as with the general rule, and to aid in the superior or successful adjustment of each child to its complicated environment. True education should aim at making the best possible of every individual. It should make allowance for difference of constitution and temperament, but should reach a high standard in each type. The old rough distinction into clever boy, average boy, dull boy, should give place to a recognition of the individualities of children, and a knowledge of the best way of dealing with each. When education has been enriched by this knowledge and spirit, it will really be, under another name, that science of Eugenics, for which some thoughtful inquirers are seeking. It will at any rate tend to conserve and improve the national health, happiness, and fitness.

The time then has come when hygienic physiology, or school hygiene, should be recognised and demanded as part of the professional training of every teacher. It matters not that many, or even most teachers, may not be called upon to *teach* hygiene. The teaching of elementary hygiene to pupils is not at present under consideration. Such instruction should be given in every school, and in every class of school, so that the knowledge of the laws of healthy living should be as widespread as the ability to read and write. What I am specially insisting upon is practical hygiene and that physiological knowledge of children which every teacher needs for the fulfilment of the higher duties of his profession. Every master has not only to teach subjects but to educate living beings. How will a knowledge of physiology or hygiene help me to teach mathematics? This question was put to me not long ago. It will help you in many ways, was my answer, not only to teach mathematics, but to educate boys.

A professor of mathematics once stated in my hearing that he could sometimes see his students visibly breaking down. He was quite surprised when I asked him, Why do you not stop them when you see the symptoms? A teacher's duty should carry him beyond his subject to the living pupil.

Whether a teacher is responsible for classics only, or for mathematics

only, or for the whole work of a class, he has to do with a certain part of the time in which growth is proceeding, in which a young life is adjusting itself to its environment, and his work is, by certain subjects, to guide the growth or facilitate the adjustment in special directions. He should know, for example, whether the temperature and atmosphere of his room are suitable for class work; whether the light is sufficient and properly arranged to allow of every pupil seeing without eye-strain; whether the shape or arrangement of the seats is likely to encourage proper posture; whether, as a whole, the class before him is fresh or tired, and whether individual pupils of a weak or neurotic constitution are physically and nervously fit for the special exercises before them. He should know how long he may expect or ought to demand attention from the class or from individual members of it. And he should have a clear idea, in view of all the tasks imposed upon the pupils, and of their individual peculiarities, how much home-work is consistent with their well-being. He should be prepared for and able to deal with special cases of inattention, restlessness, stupidity, and even sullenness, because he is aware of the real cause. His knowledge of hygienic physiology will make him pause before resorting to corporal punishment, or losing his temper. He will thus show himself qualified not merely to teach his subject, but to guide the physical, mental, and moral development of his class.

As far as Scottish teachers in State-aided schools are concerned, the excellent recommendations of the Inter-Departmental Committee have already borne fruit. For the Education Department has issued a request to University Local Committees and other training authorities that all students preparing for the Teacher's Certificate shall hereafter receive not only theoretical but clinical instruction of a kind calculated to provide this hygienic knowledge, and to make that knowledge real power in the teacher's hands. It is still unfortunately the case that many teachers—especially in secondary schools—have received no professional training. But if one may interpret the sign of the times, the day is not far distant when the teachers in all schools of recognised standing shall have passed through a course of theoretical and practical instruction bearing upon their special life work.

And it is now, I hope, impossible for any student of education to go through a systematic course on the theory of education, either under a professor of the subject or otherwise, without having the fact driven deeply home that on one side education is a physiological process, that it is primarily modification of the central nervous system and the co-ordination of that system with the muscular and other systems of the body; and

further, that this co-ordination and organisation can be fully carried out only where there is a sound body and a healthy environment. This leads the student to realise the importance of acquiring some knowledge of the nervous system and its relation to the rest of the organism, and of being able to note and interpret the various signs afforded by movement, posture, speech, handwriting, rate of growth, and habits of conduct.

But why should such knowledge be a sealed book to the secondary teacher, and why should the hygienic standard of many secondary schools fall below that of elementary schools? The proportion of children in secondary schools who need special attention is, perhaps, not much less than in primary schools, and the strain of mental work is on the whole greater. Some of the best private schools do, indeed, pay a great deal of attention to the physical and hygienic side of education, and have medical men connected with them who advise as to the treatment of special cases. These schools do excellent work, but they are the exceptions in this matter. I am glad to know, also, that other schools are beginning to set their house in order, and to give full recognition to the importance of health and health-promoting arrangements. The Merchant Company in Edinburgh, for example, is developing some interesting reforms in its great schools for girls, and has appointed two lady doctors to examine and supervise the pupils. But still better results would be produced, even in these good schools, if all the teachers had received a training in school hygiene, and were thus able to co-operate more intelligently with the medical supervisor.

The work in secondary schools is more advanced, home-lessons add to the strain, the preparation for such examinations as the Leaving Certificate and University Preliminary necessitates long-continued and severe labour on the part of teacher and pupils. Yet many of the teachers have had no instruction in hygienic physiology, and in many of the schools the rooms are badly ventilated and over-crowded. The close and vitiated atmosphere leaves both master and pupils fatigued and nervously exhausted when the day is over. Further, in some of the schools no arrangement is made for periods of recreative exercise or short runs in the open air. My inquiries lead me to believe that in certain large secondary schools in Scotland, the pupils are not sent into the open air from the time school work begins at nine till the midday interval at 12.30 or 1 o'clock. When they leave one class-room they pass into corridors where the atmosphere is not much better than in the rooms. Their place in the first class-room is almost immediately taken by another set of pupils. Thus during a considerable part of the day, rooms are not regularly flushed with fresh air.

The energy and vitality of both teachers and pupils are lessened. Yet sustained and severe mental work has to be done in an atmosphere which is calculated to destroy the power of attention, and seriously to affect the health. The strongest teachers and the hardiest children may get along for a time without showing the evil effects, but many must suffer severely and perhaps permanently.

It is surprising that parents and medical men have not loudly protested against such a state of things in schools of good reputation: it is a pity that the teachers should be too long-suffering and bear silently with working conditions which are harmful to themselves and to their pupils. Hygiene must have more to say in drawing up the future time-tables of these schools.

Up till now, the secondary schools have admitted to their staffs men who have enjoyed no professional training whatever. That state of matters is apparently drawing to an end. If teachers were really serious in claiming that teaching should be ranked as a learned profession with its own special professional knowledge, they would insist that students preparing for an educational career in higher-class schools should devote at least one year, including both a winter and a summer session, to professional and practical training. This year should be spent in mastering the secrets of professional skill, and the student among other things should take a course in Hygienic Physiology. Such a course is well mapped out in the Syllabus of The Sanitary Institute. It would naturally include the following:

1. The physiology of the senses as related to school work. Methods of testing sight and hearing. The nascent and plastic periods of the various capacities and powers.

2. The muscular system and its relation to the central nervous system. Physical exercise, correct posture, value of alert and precise movements, importance of manual training, eye-drill, mouth-drill, meaning of facial twitchings and other 'tics,' fatigue, school seats, desks, and other furniture.

3. Light, air, and temperature in the school-room.

4. First aid hints for common school accidents, symptoms of common infectious diseases, nervous and nutritive signs, rate of growth.

5. Construction of time-tables to secure renewal of air, alternation of subjects, recreative exercises, rest periods for the teacher.

6. Clinical instruction in the schoolroom.

How is such a course of theoretical and clinical instruction to be given? There is no doubt that the demands upon the time of those students, who at the Universities and training colleges are preparing for the Teachers'

Certificate, are already almost too great. The course at present extends over two years. But the growing demands, both on the culture side and on the professional side, seem to suggest that another year should be added, and that the professional subjects should be spread over a three years' period. This would produce better results, and would prevent the present enormous strain on the health and energies of the students. The instruction at present given in physiology and hygiene is slight, and is apparently not intended to fit students to note and understand the physical condition and needs of the pupils. To meet the requirements of the Education Department, a course of a more practical kind will have to be organised by the various training authorities. For the success of such a course a great deal will depend upon the kind of lecturer appointed.

It is probable that after the passing of the Education Bill, there will be an earnest attempt made to reorganise the arrangements for the training of teachers. It is likewise probable that medical inspection of schools will be generally established. The Report of the Inter-Departmental Committee is very decided upon this point. "No form of educational organisation can be considered to be complete which does not make provision for the systematic reference of questions of school hygiene and the special treatment of individual scholars to medical experts." The Education Bill, moreover, gives power to school boards to provide for medical examination and supervision. Assuming, then, that medical experts are appointed to supervise the schools in each district, it would seem natural that these medical officers (who are not only to be "fully trained," but "to have made a speciality of this kind of work") should be asked to give a course of lectures on Hygienic Physiology to the teachers in their districts. Where local or district arrangements are made for training teachers up to the lowest stage of efficiency, this plan would work very well.

At the central training colleges, or the Universities, where the more capable students will receive their training, in addition to the lectures given by the professor of education on the subject, there may be a special lecturer appointed, and the medical officer, who is connected with the practising schools, would also be available. The clinical demonstrations could be arranged for in the practising schools. In every school of any size, characteristic types of children will easily be found for special observation and demonstration. The variations of height, weight, build, and habit of posture, the condition of the teeth at different ages, normal and abnormal palates, twitchings and other nerve signs, right and wrong ways of breathing and speaking, weak eyesight and dull hearing, enlarged tonsils,

etc., will easily be illustrated. It will be possible to show, also, how mental ability and moral characteristics vary with the physical type. And if the lecturer, or medical officer, "has made a speciality of this kind of work," he will be able to give most valuable hints as to the school treatment of the various cases as they present themselves.

What can we expect from such careful scientific training of the teacher? This, at least, that we shall have in our schools men and women who can by sure and reliable signs mark off the children into certain more or less definite classes. The teacher thus trained will recognise the children of weakly constitution, not likely to be able to bear great strain, but whose bodies and brains may be built up and strengthened by a wisely directed education, in which sunlight, pure air, exercise, and rest need more attention than the mental training; children also of a stronger physical type, whose abnormal nerve signs mark the unstable nervous constitution, and who may be made or marred by the nature of their education; the children, finally, of robust health and strong nerves, whose education need not give any special anxiety.

The teacher will also be able to assist the medical officer by taking accurate observations, and will have correct ideas as to how these various classes should be treated, so that each individual shall receive the education which he needs. The wise teacher of the future will thus, under the guidance of the trained physician, be able so to modify the education of the various children that all will have the best chance of growing into healthy and capable men and women.

When the teacher goes forward to his work, equipped with this special knowledge, he will take with him a source of increased pleasure and usefulness, and will be conscious of a scientific interest in his work, and a national importance in his profession, which have been too much lacking in the past.

CONGRESS AT GLASGOW.

LECTURE TO THE CONGRESS.

By SIR RICHARD DOUGLAS POWELL, Bart., K.C.V.O., M.D., F.R.C.P.

THE PREVENTION OF CONSUMPTION.

THE very title of my Address predicates that Consumption, Phthisis, or Tuberculosis of the lungs is a disease which is, to a considerable extent at least, preventable, and this fact has been long known to physicians and sanatarians. The disease was described by Hippocrates,[1] who, four centuries before the Christian era, first gave it the name of phthisis to signify the wasting character of the symptoms that attended it. It is, and has ever been, a disease of civilization; wild animals and wild people do not get consumption. Assemble the same creatures in farmsteads, zoological gardens, lunatic asylums, factories, villages, towns, cities, and consumption becomes the principal disease from which they suffer and die in the zenith of their maturity. This need not be altogether so. It is a confession that science has not kept pace with evolution. It is the aim of preventive medicine to counteract the misdeeds of civilization, to police its overcrowded conditions, to minimise the penalty that must be paid for its infringement of Nature's laws. If you contrast the conditions of wild life with that of civilized communities, be it in animals or men, you perceive that the difference is essentially one of acreage. The main differences between three acres to a cow, and three or more cows to an acre are questions of abundant air and sunlight, sufficient and simple food, and freedom from accumulated dirt contaminated by animal emanations. We may only be able to deal to some small extent with the question of acreage, but we can very largely amend the circumstances of crowded human life, and restore the air and sunlight, secure the food supply, and cleanse away and prevent the accumulations of filth, even in our most thickly populated districts.

I shall in a moment speak of the virus of tuberculosis, but again I wish first to point out, as I have done on a former occasion, that the prevention of consumption involves a much wider issue than the circumvention

[1] For references to Literature see end of lecture.

of a bacillus, although that troublesome little microbe is of its essence. In their day the abolition of the corn duties and other free trade legislation and improved rates of wages probably did more to diminish the death-rate from consumption than any notification law against that disease would have effected. Medical officers of health and their brethren in all ranks of medicine have ever been the urgent advocates of all measures of public hygiene, such as revised factory laws, amended conditions of labour, and general improvement in sanitation and house accommodation which have helped to reduce the mortality from consumption by well nigh 50 per cent. within the reign of Her late Majesty Queen Victoria. Much of this work was done whilst Professor Koch was yet a child, and the right lines of general hygiene and treatment with regard to the prevention of tuberculosis were laid down and were being gradually developed unwitting of the discovery by that great pathologist of the true virus of the disease.

The names of MacCormac, Parkes, Simon, Greenhow, Milroy, Buchanan, Bowditch, must ever be gratefully and pridefully engraved upon our memories as the great pioneers in preventive hygiene, whilst those of Villemin, Pasteur, Lister, Koch, will for all time endure as the great discoverers and demonstrators of the specific microbes through the agency of which filth works its fatal effects. Now that the searchlight of science is fully turned upon the actual cause of consumption (tubercle bacillus) and the principal auxiliaries (septic and other bacteria) by which its destructive action is promoted, sanitarians and physicians are working with renewed zeal and hopefulness in its prevention and its cure.

Before I go further let me briefly remind you of the chief features of the tubercle bacillus and of its coadjutors.

I will draw your attention to a fact which is not in my experience sufficiently recognised even by the medical profession, and which is as yet quite unknown to the public: that whilst the tubercle bacillus is essential to tuberculosis, it is to the agency of these other micro-organisms, the streptococci, diplococci, influenza bacilli and the like, but chiefly the septic organisms, that the conditions for the invasion of tubercle are commonly established; and to their aid also the destructive changes in the lungs are largely due, and the hectic symptoms of the disease mainly attributable. Once grasp this fact, and the main principles of prevention and of the treatment of consumption are realised and understood.

We as yet know for certain nothing about the life history of the tubercle bacillus, except what is revealed to us in that, shall I say, phase of its existence which is passed in the animal body, or in artificial cultures under conditions approximating to those therein found.

We know that the same or a very similar organism is responsible for the tuberculosis of cattle and birds and many other animals, and that bacilli, having the same staining properties and microscopic characters, are found widely distributed in certain grasses, in the dung of herbivorous animals, and in other places. Avian and bovine bacilli are only in degree less virulent to men than the human bacillus, and there is some reason for thinking that it may yet be found that the whole series are specifically related. The tubercle bacillus belongs to the vegetable kingdom, and is allied to the group of fungi. It is, therefore, foreign to the animal body, and will probably be found to be a derivation of some saprophytic organism, which has acquired its parasitic tastes and virulence from cultivation and transmission through animal juices and tissues. It finds thus some analogy with the bacillus of anthrax, of tetanus, with actinomycosis, and other earth-borne microphytes. If this be so it will be folly to suppose that you can wholly eradicate the source of the disease, but you may entirely or nearly remove the conditions under which it can become virulent to the human being. The human parasite cannot, for instance, live for five minutes in direct sunlight, and but for a short time in diffused sunlight, whereas it may remain virulent for months in dust and darkness, and in damp, dark localities it may even undergo a feeble growth.

Let me glance a little more in detail at some of the favouring and preventable conditions that make for tuberculosis.

Condensation of the population is one of the root causes of consumption, and this, like most other causes, is mainly operative amongst the poor. I will not stop even to summarise the indications for the removal of this cause. They are obvious enough, but in effective treatment they are amongst the very difficult municipal and State problems that call for deep and sincere consideration. There are, however, three interesting questions of far-reaching importance which are more urgently brought before us in thinking about the conditions present in the crowded tenements of our cities:—

The question of infection.

The question of infant mortality and physical degeneracy.

The question of milk supply and alcoholism.

Under experimental conditions, such as inoculation under the skin or spraying the immediately surrounding air with matter containing tubercle bacilli, tuberculosis can be directly communicated to animals and has accidentally been communicated to man. Cornet[2] showed that susceptible animals when sprayed with infected dust became tubercular. Flügge[3] more recently has shown that similar animals sprayed with watery

mixtures of sputum, or coughed at in a close cage for a given time by consumptive patients, acquired the disease. These and other observers[4] have shown, that upon the floors and surroundings of consumptive patients dust or foods left for a certain time will become contaminated by tubercle bacilli. These observations and experiments are valuable in demonstrating conclusions that logically follow from the fact that the sputum of the consumptive is laden with tubercle bacilli, and that under certain conditions that are directly experimental (and some unfortunate accidents have occurred to show this), and proportionately under conditions of concentration from over-crowding and bad ventilation, infection may occur.

Tuberculosis is a virus disease, and under certain conditions a directly infectious one. Now there can be no doubt that in our slums, in our dark alleys and crowded tenements, and in the dusty and dirty conditions in which many of our public places and conveyances are still kept, and with their contamination by dirty people, the required experimental conditions are approximated, and many persons acquire consumption who should not do so. Cases have been given by Cornet, by Ransome, by Newsholme,[5] and many others, pointing strongly to the fact that direct infection may occur under insanitary conditions. It is also true that infection may hang about certain houses in a very tenacious manner. This may perhaps be explained by the preservation of the bacillus in full virulence, and even a low degree of cultivation,[6] that obtains in dark and damp localities. But were all the conclusions with regard to person-to-person infection which have been drawn from these experiments unconditionally true, the treatment of consumption would be impossible: in the first place, no physicians or nurses would live to treat it; and in the second, any idea of collecting patients in sanatoria would be quite unjustifiable. The disease, instead of steadily diminishing, would soon exterminate all of us, for consumption, unlike most of the specific diseases, is not epidemic, and one attack favours, rather than gives protection from, another.

Looked at more broadly, however, the facts shape themselves rather to the conclusion that the poison is a distributed one and only in exceptional cases communicated directly from person to person. It is an exaggeration of an experimental inference to say that, with cleanly habits and reasonable precaution, consumption is an infectious disease from person to person.

An extensive examination in Paris and in this country of those who have died of other diseases or from accidents above the age of thirty, has shown that a large proportion of them present local lesions in their lungs of a tubercular nature,[7] of the existence of which they have been, for the

most part, in happy ignorance. Now this almost universal potential presence of the disease suggests, amongst many other lessons, an almost universally distributed virus rather than what we understand by person-to-person infection.

TABLE I.—ANALYSIS OF 450 CASES OF PHTHISIS.

Cases with a definite family history	208
„ „ no family history	123
„ of which history was not stated	119
	450

i.e., 208 cases with positive history;
242 „ history negative or not known.

Analysis of Relationship in the 208 positive cases.

	Cases.	Ages.		
		Average.	Max.	Min.
Father only, or father with collaterals	19	29	44	17
Mother only, or mother with collaterals	22	33	50	14
Brother only, or brother with collaterals	21	32	39	21
Sister only, or sister with collaterals	26	35	58	17
Grandparents only, or grandparents with collaterals	12	25	38	17
Several members in direct line (*i.e.*, father, mother, brothers, sisters, and grandparents)	43	33	58	16
Collaterals only (uncles, aunts, cousins)	59	26	42	7
Details of relationship not given	6	37	56	28
	208			
Age-Details of cases with history		31	55	15

Analysis of the 43 cases with several direct relatives affected.

Father and mother	4
Father and grandparents	2
Father and brother or sisters	5
Mother and brother or sister, or both	11
Two or more brothers and sisters	20
Brother and grandparents	1
	43

Look at this table, and you will see that of 450 cases of proved consumption taken consecutively back from the last cases of which I have notes, in 208 cases there is a definite consumptive family history. In 30

cases and 33 cases, respectively, the father or the mother have been affected, yet in only four instances have both of them been involved.* And even this proportion is greater than I should have given as my experience of many years of the disease with married people. The conclusions of Dr. Longstaff,[8] in an elaborate statistical paper, showed that there is no extra prevalence of consumption amongst the wives of consumptive husbands or the husbands of consumptive wives.

If you look to the records of the Registrar-General,[9] you will again find that there is no extra prevalence of the disease in districts which include consumption hospitals, with their large resident population and out-patient attendances, when proper corrections are made for the local hospital mortality.

It has been demonstrated that the mortality from consumption amongst the officers, attendants, and servants of institutions for the treatment of consumption is not and has not been above that of the average population.[10]

The very elaborate inquiries of Sir Hugh Beevor[11] into the distribution of phthisis over the areas of population of a large country district comparatively isolated from railway communication have shown that over a period of 20 years there has been a uniformity of prevalence in each district that is quite unlike the character of distribution of a disease having infection as its chief means of extension. The epidemic features proper to an infectious illness are singularly wanting in this type of distribution. Too much emphasis has been laid upon the so-called long incubation period of the tubercular infection. As a matter of fact tuberculosis produced by infection in animal experiments, and in unfortunate attendants through accidental infection, has developed with great promptness and rapidity.

I am only desirous that this question of the agency of direct infection in the spread of tuberculosis should be regarded calmly and in due perspective as a possibility, not to be ignored, but to be guarded against by avoidance of those almost experimental conditions of insanitation under which it may occur. I have especially in mind, too, the social tyranny which threatens the unfortunate victim of this disease in all directions at the present time, and the danger that with an exaggerated importance attached to direct as distinguished from distributed infection the readiness to receive the poison arising from other causes may be less strenuously considered.

* I regret that I only drew up this table at the last moment, and could therefore only collect the details of a few recent cases.

It may be said that all diseases, and especially all chronic diseases, tend to weaken resistance to the effective invasion of tuberculosis. I will not labour this point, but in illustration of it, I would direct attention to the fact that diseases so apparently unconnected with tubercle as cirrhosis of the liver and other chronic forms of alcoholism[12] find a very common termination in tuberculosis. The diseases which, however, especially favour tubercle are those which are attended with or leave some remnant of unsoundness of the lungs, such as measles, whooping-cough, bronchitis, influenza. Unfortunately, there has been but small diminution in the prevalence of these diseases, within the last decades. It is important here to note that the catarrhal complications upon which tubercle is so apt to be engrafted in these diseases are almost always attributable to the septic organisms inhaled from an impure atmosphere. Any measures, therefore, which purify the conditions under which such cases are treated will tend to prevent tubercular complications.

The metallic or mineral spicular dusts to which miners and grinders are exposed destroy the protective membranes of their air passages and produce an irritation of the lungs, upon which tubercular infection is easily engrafted. 23 per cent. of the Redruth miners in Cornwall die of phthisis as against about 8 per cent. from all other causes,[13] whilst the death-rate from that disease amongst the rest of the population in this district does not exceed the normal. We may look to a great diminution in this death-rate, which is largely preventible.

Hereditary influence has more to do with the incidence of phthisis than is generally accepted. Up to recent times, before the discovery that a specific microbe was essential to the incidence of many diseases, the terms hereditary disease and hereditary tendency to disease were almost synonymous and were frequently so employed. But, perhaps with the exception of syphilis and smallpox, the actual hereditary transmission of a virus is almost unknown. The majority of acknowledged hereditary diseases, such as defects and deformities, are of the nature of atrophies or of redundancies from want of trophic nerve control. There is no virus in the question, but a defect in the formative power or control. We again cannot explain away the facts that rheumatism, gout, neuroses, alcoholism, loss of hair, arterial degeneration, and premature senility run in families. Further, it cannot be denied that certain families are more vulnerable to specific infections, such as ringworm, scarlet fever, enteric fever, and that such diseases run in them a graver course. In these cases there is no question of transmission of a virus from parent to child. The only rational explanation would seem to be that some subtle mal-formation or impaired

trophic power of a tissue or set of tissues belonging to one or other of the primary plasmic layers is inherited.

Such a view brings at once all the cases of hereditary predisposition to disease in line with hereditary atrophies. The disease itself may come through infection, as the sickly forest tree is attacked by lichens, according to its peculiar defect: or it may arise through the undue growth of an inferior tissue, as a soil sterile to wheat will grow tares: or it may come by way of chemical deposition, a defective adequacy in cell power: or again, the mere tenure of vitality is restricted, old age prematurely arrives in certain tissues or in the whole organism. Some recent authorities have roundly asserted that heredity plays no part in tuberculosis, and that insurance offices are wrong in rejecting or surcharging a life on hereditary grounds. As, however, a lawyer may plead for his client "not guilty" and "justification" at the same time, so the more cautious of those who deny heredity in tuberculosis maintain that the family prevalence is really due to infection.

Mr. Hoffman[14] brought before the British Congress some statistics which he regarded as discrediting the value of family history as a factor in the ætiology of phthisis. He declares that for assurance purposes at least family history is of no value, and indeed often misleading. The statistics he brings forward, however, when carefully scrutinised, do not seem at all to bear out his position.

By an ingenious plan, Mr. Hoffman's medical colleague, Dr. Hamill, made a special note of 40,000 persons, who coming up for a second assurance were rejected for one reason or another within a period of twelve years. Of these, 16,532 were males, and 5 per cent. of them died within that period from consumption.* A further analysis shows that—

Of 958 rejected for personal consumption, 22·5 per cent. died of that disease within the period stated.

Of 496 rejected for family history alone, 5·3 per cent. died of consumption.

Of 15,078 rejected for causes other than either personal or family consumption, 3·9 per cent. died of consumption.

When we remember that these lives were all rejected and the results recorded within twelve years, and that their currency cannot therefore be taken to have averaged more than five or six years, a mortality of 3·9

* I am indebted to Mr. Besant, Assistant Actuary of the Clerical, Medical and General Life Assurance Society, who has kindly gone through Mr. Hoffman's statistics with me.

per cent. is high for persons without family predisposition or recognised tubercular disease, and would suggest inadequate selection. Still more is it fatal to the contention of the author that family predisposition is of little consequence when we find that this factor alone causes a mortality of 5·3 per cent., or 1·4 per cent. greater, within the short time of observation. And when we combine the male and female lives, the percentages become 3 for general and 5·5 for hereditary causes respectively. Mr. Hoffman would get out of the difficulty by saying that the family history cases were probably weaklings, and were subject to infection. But the 15,000 rejected for neither family nor personal consumption were undoubtedly weaklings or battered lives, and I have given some reasons to doubt how far the argument of person-to-person infection holds, apart from special predilection or experimental conditions.

I would now draw attention to some grave defects in our civilisation which tend to lower resistance to all diseases, and especially to tuberculosis, which are remediable, and which only require national determination and resourcefulness for their removal. I have shown how the mortality from consumption has fallen with generally improved sanitation and amendment of the conditions of life.

TABLE II.—ENGLAND AND WALES.

Deaths per 1,000,000 living, from various causes, Males and Females. Average of each five years from 1881 to 1900. Reg.-Gen. Rep., 1900, T. 18.

Average of each five years from 1881 to 1900.	1881—1885.	1886—1890.	1891—1895.	1896—1900.	Increase or Decrease.
All causes	19,403	18,695	18,701	17,703	−1,700
Measles	413	468	407	421	+ 8
Scarlet Fever	436	241	182	134	− 302
Whooping Cough	459	444	398	358	− 101
Diphtheria	156	169	253	272	+ 116
Enteric Fever	216	199	173	173	− 43
Influenza	4	34	415	308	+ 304
Starvation (want of breast milk)	15	10	11	12	− 3
Phthisis	1,830	1,635	1,461	1,321	− 519
Other forms of Tuberculosis, including Scrofula and Tub. Meningitis	421	421	420	385	− 36

A glance at this table will show you that the fall of the death-rate from consumption is, to at least a great extent, coincident and commensurate with the decline in mortality from other causes. The fight against consumption is only a part of a more general campaign, and whilst concentrating our attack upon a particular poison microbe we must co-ordinate it with the strategy of a larger battle-field.

Public opinion has now ripened to the view that a large percentage of the British race is dwindling in physique. Of the truth of this there can be little doubt, and but for the strenuous efforts of the public health departments, the rate of mortality would be appallingly on the increase instead of gradually declining.

Speaking in round numbers a sixth, or 16 per cent., of our population die before they arrive at the age of 12 months. It takes another 20 years for another sixth to pass away; again another 20 years for the next sixth, and again in another 10 years a further sixth.

Table III.—Infant Mortality.

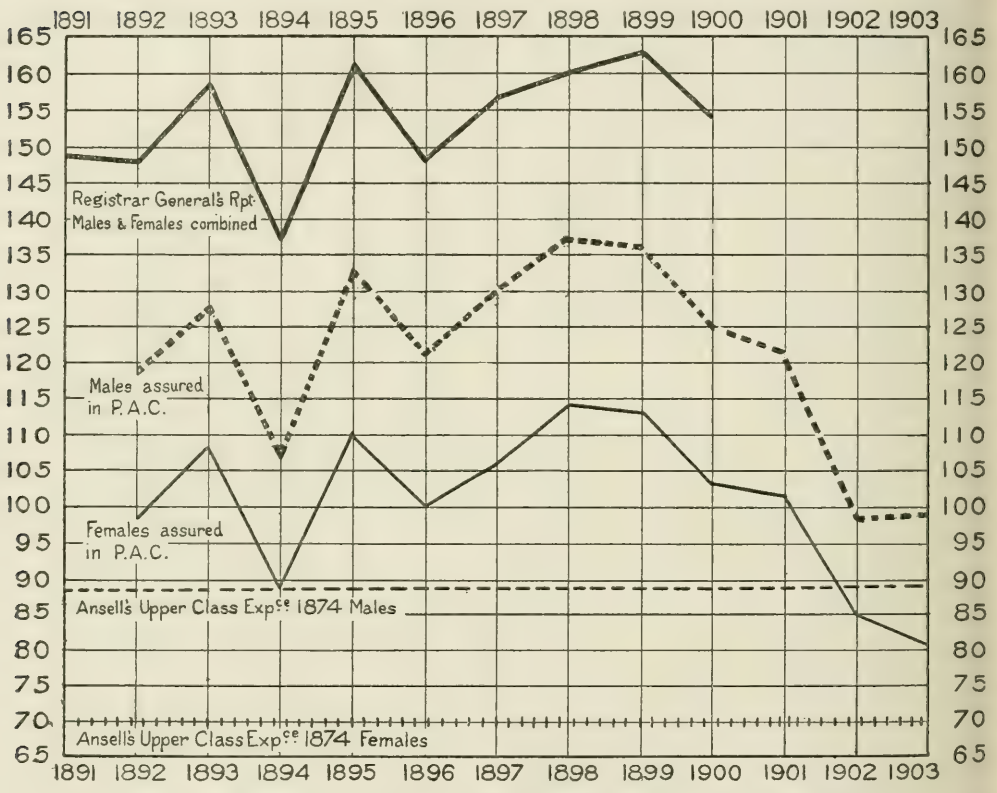
England and Wales.		*London.*	
Period.	Annual Mortality of Infants under one year of age per 1000 births.	Period.	Annual Mortality of Infants under one year of age per 1000 births.
1851—60	154	1841—50	157
1861—70	154	1851—60	155
1871—80	149	1861—70	162
1881—90	142	1871—80	158
1891—1900	154	1881—90	152
		1891—1900	160

One would, of course, expect a considerable death-rate in the first year, and especially in the first few days of life. Premature and difficult labours and unviable children are amongst the normal risks of that period. To what extent then is this enormous death-rate, which has not changed for 50 years, *abnormal*, *adventitious*, *preventable?* We hear much in protestation against the diminishing birth-rate in this country. Do we take sufficient, reasonable care of those that *are* born? And, what is more to the point, are the circumstances under which so large a proportion of them die such as to damage the lives of the survivors? The survival of the fittest is a conception only applicable in its brutality to wild life in the animal and vegetable kingdoms. If the game were fairly played, civilised life would be impossible.

I have had by the kindness of Mr. Whittall, the Actuary, and Mr. Collins, one of the chief clerks of the Life Assurance of which I have the honour to be a director, this diagram-chart drawn out, showing the death-rate per 1,000 of infants under one year of age during the ten years 1890–1900. The upper black line gives the general death-rate of males and females, and ranges as you will see between 137 and 163 per 1,000 as shown in Table 24, p. CIV. of the Registrar-General's Report for 1900.[15] Through the kindness of Mr. Frederick Schooling, actuary of the Prudential Assurance Company, Mr. Collins has been able to trace these

other curve lines, dotted and thin respectively, giving the rate of mortality amongst a large number, perhaps half a million, of infants under twelve months who have been insured by that society. It ranges from 106 to 137 per 1,000 for males, 89 to 114 for females. The notable downfall

Comparison of the Number of Deaths occurring among 1,000 Infants under one year of age, during the ten years 1890 to 1900.



Registrar-General's Report, 1901, page CIV. ——————
Prudential Assurance Co.—Males . . ▪▪▪▪▪▪▪▪
„ „ „ —Females . . ————

NOTE.—The lines at the lower part of the diagram (males – – – –, females ▮▮▮▮▮▮▮▮▮), refer to the rate of mortality experienced amongst infants in the Upper Classes, published by Mr. Charles Ansell, in 1874.

for 1902 and 1903 is attributable to the mild winter and cool summers, and will, I fear, not be maintained. Now, it must be remarked that the Prudential mortality, whilst being almost exclusively limited to the poor,

is more favourably influenced than the general mortality amongst that class by one or two facts. Firstly, they do not insure illegitimate children, and insurances are not usually effected until a month after birth, as the benefit of insurance is not received until three months have elapsed. The lines of mortality, however, as you see, exactly conform to those of the general mortality. An interesting work was written by Mr. Charles Ansell,[16] actuary of the National Life Assurance Society, in 1874, on statistics of families in the upper and professional classes, reckoned from probably some 20,000. From these statistics the straight dotted lines on the diagram are derived, showing the infant mortality below the age of one year at 89 per 1,000 for males, and 70 for females respectively. There have been no further statistics of the same kind since this laborious work of Mr. Ansell, and probably there would be an appreciable diminution now upon the upper class mortality of 1874. But the figures are at least in sufficiently striking contrast with those of the general infant mortality, and the, to a certain extent, selected and minimised death-rate amongst the more thrifty poor shown in the Prudential Assurance statistics. They may be said to represent the ideal rate. And, inasmuch as the general death-rate of the Registrar-General would, of course, include that of the upper classes, a margin of at least 60 or 70 per cent. would seem to be attributable to conditions connected with the insanitation of poverty, most of which is theoretically and much of which is practically preventable.*

Ansell shows by another table that the bulk of the mortality comes within the first few days. I know of no such table drawn from the Registrar-General's Reports, and it would be interesting to know how far they conform to it.†

Now the point I want to emphasize as deducible, amongst others, from these tables is, that a mortality of one-sixth amongst infants within the first year must necessarily mean a lowered vitality, a lessened viability and developmental power amongst the survivors. It is, I believe, reckoned

* In 1900 the proportion of deaths of infants under one year to registered births was 154 per 1,000, about equal to the average of the preceding ten years. Taking registration counties, however, it ranged from 79 to 100 in the rural counties of Rutlandshire, Dorsetshire, Wiltshire, and Oxfordshire; from 175 to 180 in Warwickshire, Notts., Staffordshire, and Lancashire, which include a large urban registration.

When we consider that whilst in 1861–71–81 the rural population of England and Wales had diminished in proportion to that in towns from $\frac{1}{3}$ to $\frac{1}{7}$, and that it had further diminished between 1881 and 1901 from $\frac{8}{17}$ to $\frac{7}{25}$, *i.e.*, from rather more than half to considerably less than one-third, we find reason, in this crowding of the population from rural into town districts, in part to account for the maintenance of the mortality rates amongst infants. It certainly speaks much for the zeal and resource of our Medical Officers of Health and the Boards whom they advise, that the mortality rate has not enormously increased.

† Dr. Templeman has contributed a valuable paper on the Causes of Infant Mortality to this Congress.

in war that for every man killed there are five or six wounded, and so with disease; conditions which kill 16 per cent., maim and stunt and make weaklings of at least a proportion of those that remain, and cause them to become further decimated or weakened by such diseases as rickets, measles, whooping-cough, bronchitis, and tuberculosis in early life. Thus we find of every 1,000,000 born but 680,033 remaining at the age of twenty, and of these survivors, our recruiting statistics tell us as to the percentage who are physically fit, *i.e.*, who come up to the standard required, and who can bear the wear and tear of the first year or two of a soldier's life.

But after the age of twenty what becomes of the 680,000 remaining of each million?

If we take the 680,000 general population surviving at age twenty, and compare their viability with that of an equal number of those selected as good lives for Life Assurance, we shall find the results recorded in this table, which has also been kindly drawn up for me by Mr. Collins (Table IV.). You will see that there are 12,000 less living amongst the general than the select population at thirty, 27,000 less at forty, 46,000 at fifty, 59,000 at sixty, 56,000 at seventy, and 29,000 at eighty. This is depicted by the curved lines and figures of the diagram (p. 363). Half of these deaths between twenty-five and thirty-five are from consumption.

TABLE IV., *showing the number of Survivors at each consecutive age of 680,033 lives aged 20.*

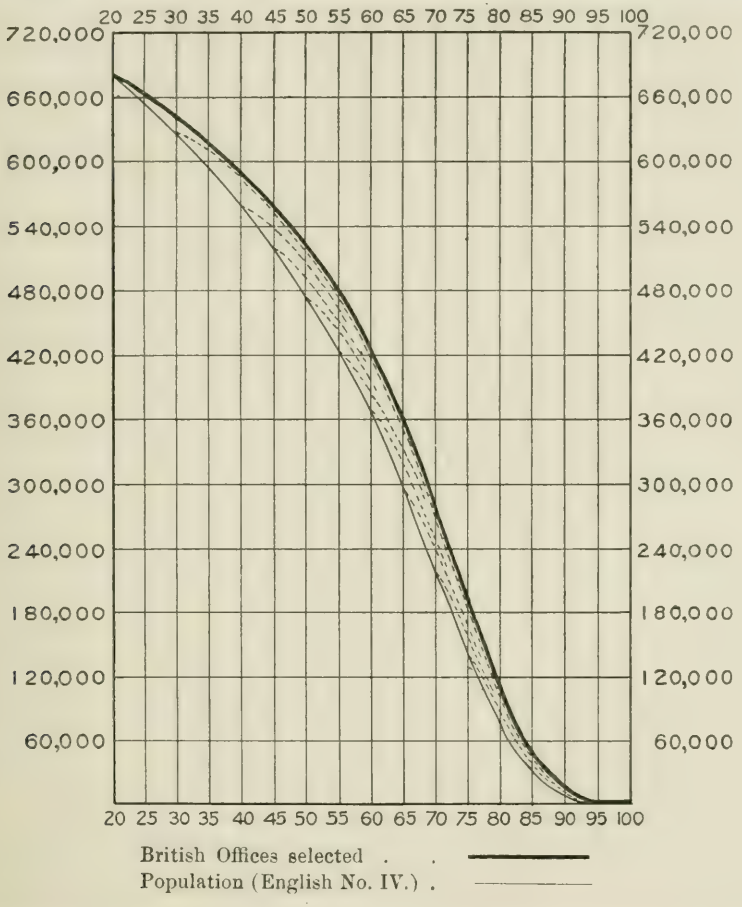
(*a*) Subject to the mortality ruling among assured lives ascertained by medical examination to be first-class at age 20, as shown by the British Offices Select Table.

(*b*) Subject to the mortality ruling among the general population, as shown by the English No. IV. Table.

Age.	(A) Select Assured Lives	(B) Population.	(A)—(B). Excess of Survivors of Select Lives.	Age.
20	680,033	680,033	.....	20
30	642,600	630,038	12,562	30
40	590,410	563,077	27,333	40
50	523,410	476,980	46,430	50
60	424,980	365,011	59,969	60
70	278,160	222,056	56,104	70
80	107,260	77,354	29,906	80
90	11,284	8,015	3,269	90
100	49	82	33	100
Total 20 to 60	23,723,853	22,515,941	1,207,912	Total 20 to 60
61 to end	5,780,478	4,612,446	1,168.032	61 to end
Total	29,504,331	27,128,387	2,375,944	Total

Curves representing the number of Survivors out of 680,033 Assured Lives, selected by British Offices, at age 20; and a similar number of Lives of the General Population as indicated by the English No. IV. Table.

The abscissa represents the age and the ordinate the number of survivors at that age.



There can be no doubt that the evils which are responsible for a high infant mortality continue throughout child life. Let us glance at the chief of these with a view to hints at their prevention.

Overcrowding and insufficient air. I need not enlarge upon this well-known condition of ill-health and mortality intensifying all infantile diseases, lowering general vitality and resistance to all diseases, and especially fostering tuberculosis. The remedy for overcrowding is a problem, and a

stiff one, but not impossible of solution, for the legislature. It is being taken seriously in hand, I am glad to know, by this city of Glasgow. As traffic communication becomes more easy, we may expect factories to go further afield, and it should not be difficult, with more space and greater legislative insistence, to secure more ample room for those employed, and to leave more room for those left in the towns.

There is no doubt that squalid home conditions are the cause, as they are certainly also one of the results, of alcoholism amongst the poor, a potent factor in the incidence of phthisis.

Defective milk supply for infants and children is one of the principal causes of infantile mortality and impaired development. According to Mrs. Greenwood, an Inspector of the Medical Officers' Department of Sheffield in 1900, only 12 per cent. of the women suckled their children.[17]

The mother's milk, the best supply for children, is most generally defective or wanting owing to the poorness of her food or the exigencies of her work. With doctors, visitors, health officers, nurses, poor-law boards and the rest, methods and resources should be forthcoming by which these cases could be dealt with, the food of necessitous mothers supplemented, skilled advice given to them as to the best kind of food to take, more rest secured to them during the nursing period.

The source of the milk supply to our towns is not adequately inspected. Clean milk obtained with clean hands and forwarded in clean vessels and without fraudulent additions or removals is not obtainable by the poor. The poor probably pay a great deal more for the milk they get than the rich. Can it not be secured to them that they get at least what they pay for? There is no adequate punishment for that form of theft which takes the shape of devitalising milk, by depriving it of cream, diluting it with dirty water, and adding other fraudulent constituents. If these poor babies had votes, would their interests be better cared for? A Royal Commission of inquiry might even be instituted on their behalf.

Fifteen years ago a Royal Commission[18] did sit and drew something of a red herring across the line of better inquiry, by exaggerating the influence of tubercle bacilli in milk upon infant mortality, to the neglect of other more promptly fatal putrefactive and fermentative poisons and deprivations. And now another Commission is sitting to correct the exaggerated results of the first inquiry in the light of Professor Koch's statement that bovine tuberculous milk is of little consequence. The truth seems to lie between the two, and there is much room for a third Commission to inquire into the best manner of supplying pure milk to country and urban populations, at a fair price. Some noble

experiments are now being made in Paris, New York, Battersea, St. Helens, Liverpool, and Dundee, to supply from depots sterilised milk in clean bottles for infants. Mr. Watt Smyth[19] is to a certain extent right, although I think unnecessarily severe in his criticism of this most praiseworthy step, when he draws attention to the absence, in this country, of sufficient inquiry as to the source of the milk thus dealt with. A glance at the last Report on the Health of Battersea[20] will show that in the milk supply of that borough at least the contractor is bound by fairly stringent conditions, which include the supervision of the farms and the manner in which the milk shall be collected and transmitted to the depots. There can be no doubt that scientifically conducted dairy farms on a large scale, with urban depots for the reception and dispensing of pure milk in clean bottles at a fair price to the poor, would pay, and would be a most laudable employment of the municipal enterprise that is often devoted to matters of much less urgent public interest and importance. Apart from the primary benefit of affording a pure milk supply at a fair price, the object lesson to mothers and families in food cleanliness would be beyond price. It cannot be doubted that such an effort, carried out on purely business principles, graced by the benevolent spirit, would be supplemented by almoners' funds for the assistance of those in actual need. If, on the one hand, the maternal milk supply of the country were increased by the supply of extra food and the securing of extra rest to suckling mothers, and if, on the other hand, a pure milk supply were secured to the poor by a system of municipal or private trading, supplemented by some charitable funds for the most needy, the infants would at least get a fair start, the falling birth-rate, if not corrected, would perhaps be more than compensated for, and the death-rate from tuberculosis amongst children and at later ages would be notably lessened.

Passing to the later school life of children up to adult age, no one will question that we want more exact information. The general opinion,

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Note.—Careful and full details as to the best methods of running milk depots are given in Mr. Watt Smyth's valuable work, and Dr. McLeary,[22] the Medical Officer of Health for Battersea, has recently contributed to the *Journal of Hygiene* an interesting article on the History and Function of the Infants' Milk Depot, which seems to have been started in Paris by Dr. Budin, in 1892, and extended to 60 French towns. The system has been tried in New York since 1893, at St. Helens, 1899, Liverpool in 1901, Battersea, 1902, Leith and Bradford, 1903.

Prof. Budin's system, justly praised by Mr. Smyth, is, it must be noted, a hospital system. The Battersea depots (and I take it the others also) are municipal systems. There is at Hampstead[21] a system for infant milk supply, also on hospital lines.

which I believe from observation to be correct, is that children's brains are being overworked and over worried, their characters but poorly cared for or developed, their bodies under-fed and under-exercised. Much sincere and honest thought is being given to this question, however, and with patience and further experience I believe it will be solved.

For Board Schools there are two considerations that seem to be of fundamental importance, and towards the acceptance of which public opinion is ripening, firstly, that as every child is now educated at the expense of the State, so a part of that education should be directed to fit him physically and morally for a citizen's service in the State, *i.e.*, to rear sound children and to defend them if necessary. The boys want education in physical exercises, to be carried out in the open air or in open sheds, calculated to develop their chest and limb power, and their capacity to handle tools and weapons. They need discipline to teach them cheerful obedience, self-control, respect for themselves and for others. Secondly, the physical part of their instruction should be so timed that a meal should be served afterwards, to be arranged by a cost payment for those who can pay, by allowance for those who cannot. And during this meal time the children should be under the discipline and example of their physical instructors. The girls should be taught cooking, cleaning, and how to rear children. By devoting a part of school life to learning these things we should become a still more upstanding race, the evils and corruptions that beset all ageing civilisations would be held at bay, and with increased vigour from more systematically developed frames, the resistance to the inroads of tuberculosis would be increased, and that disease would find fewer ready victims.

I have dwelt at, I fear, too great a length upon the general conditions upon which the prevention of consumption is based. They are inextricably mixed up with the specific cause of tuberculosis.* I shall now be able much more briefly to allude to specific measures of a preventive kind.

It is in darkness and filth that tubercle flourishes. Let each and every person in this assembly preach and illustrate the gospel of cleanliness and temperance, to keep the dwelling airy and cleansed from all dust and garbage, and each will be the nucleus of a falling death-rate from consumption. There is unquestionably a very great deal of tubercular material, bacillus-containing dirt, about our streets and public places of resort that need not be there. If no person, and especially no consumptive person, would ever contaminate his surroundings with ex-

* See Paper by Sir R. Temple on "Measures for the Prevention of Malaria and Tuberculosis in the Andaman Islands," read before this Congress.

pectoration, an enormous reduction in the amount of active dangerous poison would at once take place.

Certain special precautions are necessary in the self-management of consumptive patients. They may be summed up in simple directions. Use proper spitting receptacles as advised by the doctor, learn to save coughing for convenient times, and always hold a handkerchief before the mouth when coughing. Preserve generally the utmost personal and room cleanliness.

It is certainly necessary that a keener supervision, and with more authority, should be exercised by our sanitary medical officers and their inspectors with regard to the cleanliness of public places of resort, vehicles, hotels, public houses, lodging houses.* It is, for instance, appalling to the sanitarian to notice the average conditions of our local and suburban railway carriages, and to note how the poisonous dust is raked up and distributed about by the porter's brush, and the remnants of dusty filth scattered about the platforms. No adequate cleansing instrument has yet been invented to replace those barbarous weapons, the housemaid's broom and the porter's brush. It is not the tubercle bacillus alone, but the general organic filth that renders it impossible for those with incipient or arrested phthisis to live in town conditions and to resume office work.

Voluntary notification of consumption should be encouraged in all municipalities, and there should be a thoroughly good feeling cultivated by the district medical officer† and his practising colleagues for their mutual educational benefit, and for the advantage of the community they serve. The whole sanitary control of a district must be in the hands of the medical officer of health, but his work will be to a great extent paralysed if he have not the cordial co-operation of his confrères, the medical practitioners of the district. Each medical man should be the adviser of his own clientèle, and in all cases of sanitary difficulty he should have the advice and authority of the health officer at hand.

Early diagnosis of tubercular disease is of the utmost importance to the individual and to the public, and facilities for the bacteriological investigations should be within easy reach of every medical man, gratuitously for the poor, at a moderate fee for the better-to-do.

There should be a Sanitary Association in every district for the consideration and discussion of all local questions of public health.

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* I am glad here to testify to the admirable cleanliness and sanitation of the public tram cars of Glasgow, and the downright intimation in each of them that "spitting is forbidden."

† An able address by Dr. Newsholme, already alluded to, gives valuable hints on the duty of family practitioners in relation to phthisis.

The principles of sanatorium treatment are so well known that I will not dwell upon them. They are all calculated for the prevention as well as the cure of the disease. They consist briefly:

1. In the preservation of aseptic surroundings for the patients.
2. In securing the natural antiseptic qualities of air and sunlight which are not expended in the oxidation of organic impurities.
3. All measures of regulated rest, abundant and selected food, and regulated exercise are adopted, calculated to fortify the resistance and strengthen the natural anti-microbic powers of the patient.

As yet little or no more direct therapeutic treatment has been adopted at sanatoria.

As a means of prevention, or diminishing the death-rate from tuberculosis, the effect of sanatoria has as yet been quite insignificant, for the reason that their adoption for the treatment of the poor has not as yet been organised. It is from the poor and crowded populations that the vast death-rate from consumption arises, it is from them that the great bulk of poison material emanates. Yet measures for the treatment of consumption amongst them are still ludicrously inadequate. Under the influence mainly of tuberculophobia at the present time, general hospitals are shy of taking in tuberculosis, convalescent institutions are refusing to receive them, special hospitals have such long lists waiting that they do not receive them in time, and injunctions are frequently sought against the occupation of suitable sites for building more sanatoria. Local efforts on a microscopic scale are here and there started by benevolent people, but they must serve as the mere nuclei of example and encouragement for larger efforts undertaken by municipal authorities throughout the kingdom, before they can effect any notable improvement in the prevalence and death-rate from consumption.

Our great hospitals are not doing their duty in this matter. If a conference were held between the representative authorities of all the great hospitals in each district of the kingdom, a means might be found by which a small percentage of beds could be set apart under special conditions for the reception from the neighbourhood of early consumptive cases for diagnosis and treatment to be drafted on to country branches for sanatorium treatment.* This must be supplemented by proper infirmary accommodation for advanced cases.

* This is being done on a small scale by the Middlesex Hospital For an interesting report of a "Hospital's Committee," appointed by the Westmoreland County Council to investigate this question of providing accommodation for consumptives, see leaflet pub-

There are already several homes scattered about for the treatment of advanced cases of consumption. What is wanted is a small home in connection with each county according to its population. This would probably mean but little more than a better use of the expenditure that already directly or indirectly burdens the rates through this disease.

The maintenance of the families and the after care of poor consumptive patients is a great and a difficult problem. But it is not an insoluble one. The problem remains unfaced at present, but consumption is very expensive to the rates, and more might be done without much, if any, more expenditure. Benefit societies, wielding enormous sick assurance funds for the poor, would find it to their advantage to co-operate for the maintenance of the families. Industrial insurance societies would find a means to co-operate in some way towards the same end. As pointed out by Dr. Hoffman[25] in the valuable paper to which I have alluded, direct contribution to the sanatorium treatment of the assured who become ill from tuberculosis is impossible except, as in Germany, where the insurance is by the State. The companies have no funds for charitable purposes, yet, as pointed out by Dr. Hoffman, some half-million dollars a year are lost by the American Prudential Assurance Society by the consumption death-rate alone. A portion of such loss would go some distance towards reassurance for diminished death-rate and increased longevity. There is no doubt too that a much larger loss is saved by the lapse of industrial insurance policies through inability of invalids to keep up the premium payments; and if means were devised on any considerable scale for maintaining policies amongst those of the industrial classes who become tubercular, it would become still more the interest of such insurance societies to co-operate in the treatment of such cases. An interesting experiment, to which I can only here briefly allude, has been proceeding in Germany since 1881, when the Emperor William I. first inaugurated a system of State insurance. Under this system the State, the employer, and the workman each contribute in equitable proportions towards insurance against sickness, accident, and old age. An essential condition is that the contributions by all three participators are compulsory. Under this scheme, amongst other advantages, funds are forthcoming for the maintenance of families during the sickness of the breadwinners. The system of insurance has naturally also stimulated hygienic supervision, and from this and other causes the

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lished by the National Association for the Prevention of Consumption, reprinted in Appendix VI. of Dr. Hillier's work. It is impossible to deal, with even approximate accuracy, with this large subject in the course of one lecture. It has been skilfully and suggestively handled by Dr. Hillier in his above quoted work.

death-rate from consumption has fallen in Germany since 1886 from 31 to 19 per 10,000. It will probably be long, however, before any system of this kind will recommend itself to the British workman.

Much has been said and done with regard to the distribution of leaflets and pamphlets broadcast as an aid to the prevention of consumption. I must say that it is my belief that on the whole this scattered literature has done more harm than good, by spreading panic through misconception or exaggeration, and that the end would be best served by limiting such to authentic and uniform information, to be obtained from the Health Officers by medical practitioners of their districts, for distribution to the heads of the families where the disease is prevalent. Some unfortunate and ludicrous instances of "tuberculophobia" are given by Dr. Bulstrode in his Milroy Lecture,[26] and others have come within my own experience.

The Medical Officer of Health can scarcely fail to be aware, and can be always informed by private notification of consumption prevailing in definite centres, and has, or should have, control over public places and houses.

Again, it would be the clear duty of a private medical man if case after case of consumption were, as sometimes happens, to come under his cognizance in a given house, to notify the fact to the Medical Officer of Health. And if a poor man have a case of consumption in his house, and has not the means to carry out the hygienic arrangements desirable, he would be advised by his doctor to seek the help of the Medical Officer of Health, who would have powers from public or charitable sources to give him that help in the way of nursing, supervision, cleansing, disinfectants, etc. In this way and degree voluntary notification or action upon public information is of course legitimate and right. Beyond this I do not see that the liberty of the subject can wisely or advantageously be intruded upon. It is, of course, a large question, but in the first place practical steps could not be taken upon compulsory notification* in the way of isolation, unless the community were prepared permanently to support all wage-earners or salaried persons who are ousted from their occupations. Very possibly, some—I think very slight—diminution of phthisis mortality might be effected by so drastic a measure, but at much too great a cost to the community in many other ways.

Dr. Tatham,[28] in an able memorandum to the Congress on tuberculosis, shows that not only has there been an absolute saving of life from

* Dr. Newsholme thinks compulsory notification "certain to come." Its enactment, as at Sheffield, *i.e.*, for information, cleansing, and disinfection, is as far as he thinks practicable, however.[27]

consumption of about 50 per cent. in the past fifty years, but that there has been a postponement of the chief mortality by some ten or fifteen years, and that the saving has been greater amongst females than males.

If we look, however, to the difference between the rate of decline between the first half, 1851–80, and last half, 1880–99, of that period, we find that the rate has not been so well maintained since the discovery of the tubercle bacillus in 1882 as we might have hoped for. There are no doubt some fallacies to partly account for this, but accepting the broad fact, it may be accounted for, in the first place, by the increasing flux of the population into the towns the last twenty years, and by defective general hygiene attendant upon overcrowding. It may be due, secondly, to those measures indicated by the discovery of the specific nature of the disease not having been adequately developed.

I have shown that further perseverance in general hygiene is necessary, and I have brought forward arguments to show how inextricably these general measures are mixed up with those special to the microbe. All measures of hygiene have contributed, and do contribute, to the prevention of consumption: by fortifying the host; by minimising the parasite. Can we do more, and are we attempting to do so on the right lines?

I have shown that our measures for sanatorium treatment are on right lines, educative, administrative, curative. But these measures are in their infancy. The co-operation of our poor law and municipal authorities, charitable organisations, sick benefit and industrial and sick assurance societies, must be sought in a matter in which they have interests and great responsibilities.

The public health departments are doing much, and may do more, by the establishment of bacteriological laboratories in every borough, and by more strictly supervising public and licensed places, and by approaching and instructing the heads of afflicted families through their medical advisers.

Our hospitals and infirmaries are not doing their share in dealing with tubercular diseases.

Voluntary notification is of value in helping the medical officer of health in his arduous work. Compulsory notification, strongly advocated by some authorities, and adopted in some places in this country and abroad, seems to me to be impracticable. Rigidly carried out it would be a tyrannous measure, calculated to raise popular resentment against hygiene in general. We may, by these various measures, expect the prevalence and virulence of the tubercular poison to be on the one hand indefinitely attenuated, and on the other hand we may expect immunity to

be increased as a more robust public vitality develops from better life conditions and improved physical training. Further, as the disease becomes less prevalent, there will be fewer persons to transmit hereditary delicacy and to spread the elements of infection. Thus in time we may hope to see consumption reduced to a mere fractional remnant of its already diminishing prevalence.

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OBITUARY.

SIR JOHN SIMON.

The last of the early fathers of administrative sanitation in England has passed away, and although his official career ended nearly thirty years ago, the work that he accomplished is still valued as a basis upon which modern sanitation rests.

John Simon was born in London, on October 10, 1816, of Anglo-French descent, his grandfathers, who were both Frenchmen, having married English wives. He went, in the first instance, to a preparatory school at Pentonville, and then to a school at Greenwich, kept by Dr. Burney, a nephew of Mme. D'Arblay, with whom he remained between seven and eight years. He was next sent as a pupil into the family of a German pastor at Hohensolms, in Rhenish Prussia.

After ten months spent at Hohensolms, it was decided that he should enter the medical profession, and in 1833 he was placed as a pupil with Mr. Joseph Henry Green, then Surgeon to St. Thomas's Hospital and Professor of Surgery at King's College. His ability and industry were from the first conspicuous, and he became a member of the Royal College of Surgeons in 1838. In 1840, on the opening of the new King's College Hospital, he was appointed assistant surgeon, and, in 1845, after the communication of a paper on the comparative anatomy of the thyroid gland, he was elected a Fellow of the Royal Society. In 1847 he became Professor of Surgery at St. Thomas's Hospital, and so renewed with that institution a connexion which had begun when he was a pupil, and which was severed only by his death.

In July, 1848, Simon married Miss Jane O'Meara, and in the same year he was elected to the newly-constituted post of Medical Officer of Health to the City of London. The qualities of mind displayed in his official reports as Medical Officer of Health for the City, reports in which he laid down the principles upon which alone any public sanitary administration can repose with safety, led the Government, in 1855, to offer him the newly-created post of Medical Officer to the Privy Council. After some consideration, the offer was accepted.

On his appointment to be Medical Officer of Health to the City of London in 1848, the chief subjects requiring his attention were the water supply of the City, the offensive or injurious trades carried on within its limits, the intramural interments, the impossibility of ventilation in its blind alleys and courts, and the lack of proper scavenging.

The reports made as Health Officer to the Privy Council cover a wider area of observation than those made as Health Officer to the City; and they are, in their essential nature, consecutive and complementary to each other, although it was the author's custom sometimes to quote a demonstration or an argument which he had supplied or advanced on a previous occasion. In an article written for Quain's "Dictionary of Medicine," he clearly laid down the theory that contagious emanations proceeding from the sick must consist of definite particles, since they obeyed the laws of definite particles and no others; and that these particles must differ among themselves, being in every case peculiar to the disease which alone produced them, and which alone they could reproduce. This theory has since received its proof and its complete development in the growth of the science of bacteriology; but, before the disease-producing bacteria had been either identified or cultivated, Simon saw that the theory, if established, would greatly increase the definiteness and the success of measures of sanitary reform; and he diligently pursued any lines of investigation by which its correctness might be tested.

His reports—which are really State papers of high importance and of perennial interest—were rescued from the living death of interment in old blue-books by The Sanitary Institute, and, together with the reports to the City, long reports on the History and Practice of Vaccination, and with essays of great value upon contagion and upon experiment as a basis of Preventive Medicine, were published in two volumes with the assistance of the author, and under the editorship of Dr. E. Seaton. These volumes show the general nature of Simon's work, and the spirit with which he addressed himself to the removal of the evils against which it was his official duty to contend.

In the early part of 1876 he resigned his office, and was succeeded by his old friend and colleague, Dr. Seaton. Simon himself received the C.B. on his retirement, and was appointed a Crown Member of the General Medical Council. He was made a K.C.B. at the Jubilee of 1887.

He retired from the Medical Council in 1895, and passed the remainder of his honoured old age at the house in Kensington Square which had been his home for many years, and where he died on July 23rd.

A fuller account of his work and writings will be found in the volumes already referred to,* and also in his great work on "English Sanitary Institutions," published in 1890.

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*Public Health Reports, by John Simon. 2 vols., 8vo. The Sanitary Institute and J. & A. Churchill. 1887.

DECISIONS OF COUNCIL ON RESOLUTIONS PASSED AT BRADFORD CONGRESS.

The following decisions have been made since the list was published in Vol. XXIV, p. 855:—

Recommendation made in the Conference of Municipal Representatives—

> "That the amendments suggested in Dr. Eustace Hill's paper on 'Suggested Amendments of the Housing of the Working Classes Act, Part II.,' be referred to the Council of The Sanitary Institute for consideration and report, and that the Council of The Sanitary Institute be requested to ascertain the views of County Councils and Councils of County Boroughs throughout the country as to the emendation requisite in Part II. of the Housing of the Working Classes Act, and to take such action thereon as may seem to them desirable."

The Council decided that no effective action could be taken in the matter.

Recommendations passed at the Conference of Sanitary Inspectors—

> "This Conference of Sanitary Inspectors respectfully ask the Council of The Sanitary Institute to take into its early consideration the question of admitting (as Members of the Institute) any Sanitary Inspector who has held office as such for a period of ten years, who shall have either passed the Institute's Examination for Sanitary Inspector, or that of the Metropolitan Examining Board, at the reduced annual subscription of one guinea."

After careful consideration, the Council decided not to adopt such a rule with regard to the election of Sanitary Inspectors as Members of the Institute.

> "That this Conference of Sanitary Inspectors, realising the difficulties that occur owing to the limited definition of the word 'drain,' ask

the Council of the Institute to exercise its influence with the Government with a view to obtaining an extended definition of the term in question as provided in Section 42 of the West Ham Corporation Act of 1898."

The Council decided that in view of conflicting decisions, this question requires dealing with as a whole, and should, in the opinion of the Council, be fully considered and dealt with in a general Act in which proper provision can be made. The Council will, however, be glad to support this when an opportunity arises.

"That this Conference of Sanitary Inspectors is of the opinion that the law relating to the Sale of Food and Drugs requires amending, so as to enable an officer to procure samples of articles consigned to his district at any place of delivery beyond the limits of such district, and, further, empower such officer to institute all like proceedings as if such places were within the district for which he is appointed, and therefore ask the Council of The Sanitary Institute to petition the Government in favour of such an amendment."

The Council decided to omit the words "and, further, empower such officer to institute all like proceedings," and that the resolution, with this amendment, be accepted and forwarded to the Local Government Board.

NOTES ON LEGISLATION AND LAW CASES.

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For full text of these see Law Reports, which can be referred to in the Library of the Institute.

ADULTERATION.—*Food and drugs—Institution of prosecution—Sale of Food and Drugs Act, 1899 (62 & 63 Vict. c. 51), s. 19, sub-s. 1.*

By s. 19, sub-s. 1, of the Sale of Food and Drugs Act, 1899, a prosecution under the Sale of Food and Drugs Acts "shall not be instituted" after the expiration of twenty-eight days from the time of purchase:—

Held, that the laying of the information, and not the service of the summons, was the institution of the prosecution. BEARDSLEY *v.* GIDDINGS. Div. Ct. [1904] 1 K. B. 847.

BUILDINGS.—*Drainage of houses on low-lying land—London Building Act, 1894 (57 & 58 Vict. c. ccxiii.), s. 122.*

Land is "so situate as . . . . to admit of being drained by gravitation into an existing sewer" within the meaning of s. 122 of the London Building Act, 1894, if it is situate at such a level that the drainage from it will find its way by gravitation into the sewer under the ordinary conditions of the sewer, although during a substantial number of days in the year that drainage is in fact prevented from passing into the sewer by reason of the sewer becoming surcharged with rain-water and of the pressure of that water inside the sewer closing a flap or valve at the inlet of the sewer. ELLIS *v.* LONDON COUNTY COUNCIL. Div. Ct. [1904] 1 K. B. 283.

DRAIN OR SEWER.—*Pipe draining several houses belonging to different owners "Single private drain"—Local Government—Public Health Act, 1875 (38 & 39 Vict. c. 55), ss. 4, 41—Public Health Acts Amendment Act, 1890 (53 & 54 Vict. c. 59), s. 19.*

Where two or more houses are drained by a single pipe, neither the fact that the pipe is wholly situate on private land, nor the fact that the houses belong to different owners, will suffice to make the pipe a "single private drain" within the meaning of s. 19 of the Public Health Acts Amendment Act, 1890, so as to entitle the local authority, in the event of the pipe becoming a nuisance, to require the owner or occupier of the premises to amend it under s. 41 of the Public Health Act, 1875.

Semble, the words "belonging to different owners" in s. 19 of the Act of

1890, mean "not all belonging to the same owner." In order to bring a case within the section it is not necessary that all the houses should belong to different owners. THOMPSON *v.* ECCLES CORPORATION. Div. Ct. [1904] 2 K. B. 1.

FACTORY.—"*Tenement Factory*"—*Fire-escape*—*Factory and Workshop Act, 1901 (1 Edw. 7, c. 22), ss. 14, 149.*

By s. 149 of the Factory and Workshop Act, 1901, the expression "tenement factory" is defined to mean "a factory where mechanical power is supplied to different parts of the same building occupied by different persons for the purpose of any manufacturing process, etc.:—

Held, that by the words "is supplied" must be understood "is supplied from the same source," and that a building the parts of which, being occupied as factories by different persons, have each their own independent supply of mechanical power, is not within the definition.

Toller v. Spiers & Pond, Ltd. [1903] 1 Ch. 362, followed. BRASS *v.* LONDON COUNTY COUNCIL. Div. Ct. [1904] W. N. 102.

NUISANCE IN RESPECT OF DRAINS.—*Order to abate*—*Necessity for signature by two justices*—*Public Health Act, 1875 (38 & 39 Vict. c. 55), s. 96.*

An order of a Court of summary jurisdiction under s. 96 of the Public Health Act, 1875, must be signed by two justices. WING *v.* EPSOM URBAN DISTRICT COUNCIL. Div. Ct. [1904] 1 K. B. 798.

SMALLPOX HOSPITAL.—*Quia timet action*—*Evidence*—*Admissibility*—*Injunction refused*—*Public health.*

The theory of the aerial convection or dissemination of the disease of smallpox has not received the unequivocal sanction of medical science; and the establishment of a smallpox hospital, properly conducted, is not of itself necessarily such a serious source of danger to persons resident, working, or passing by in its immediate vicinity—say, a radius of 50 feet—as to constitute a public or a private nuisance for which an injunction will lie in a quia timet action.

In such an action evidence is admissible to show what has occurred in the neighbourhood of other smallpox hospitals carried on under similar conditions, per Cotton L.J. in *Hill* v. *Metropolitan Asylum District* (1879) 42 L. T. 212; approved on appeal (1882) 47 L. T. 29, per Lord Selborne, dissentiente Lord O'Hagan. *Sed quære*, whether the admission of such evidence is not wrong in principle as raising a number of side issues on which it is impossible for the Court to adjudicate without injury to absent parties. ATT.-GEN. *v.* NOTTINGHAM CORPORATION. Farwell J. [1904] W. N. 55; [1904] 1 Ch. 673.

SMOKE.—*Chimney of private dwelling-house—Club—Public Health (London) Act, 1891 (54 & 55 Vict. c. 76), s. 24 (b).*

By the Public Health (London) Act, 1891, s. 24 (*b*), "any chimney (not being the chimney of a private dwelling-house) sending forth black smoke in such quantity as to be a nuisance" is declared to be a nuisance liable to be dealt with summarily under the Act.

A club of 750 members, managed by a committee of the members, had for many years occupied premises which had previously been a private dwelling-house; the premises comprised the ordinary accommodation of a club, and there were five bedrooms for the use of the members and eight for the club staff. In the basement were cooking ranges, a large roasting grate, and a vertical boiler with furnace attached, which latter were used for heating the premises; the smoke from all of them was discharged into one flue or chimney, which sent forth black smoke in such quantity as to be a nuisance. A summons against the respondent, the club secretary, for making default in complying with a notice of the local authority requiring him to abate the nuisance was dismissed by the magistrate on the ground that the chimney was the chimney of a private dwelling-house:—

Held, that the dismissal of the summons was wrong; that the premises as such were not a private dwelling-house within the meaning of the section, and that the respondent ought to have been convicted of the offence charged.

McNair *v.* Baker. Div. Ct. [1904] 1 K. B. 208.

——— *"Chimney"—Chimney sending forth black smoke—Funnel of steam tug—Specification in order of works to be executed—Local Government—Public Health (London) Act, 1891 (54 & 55 Vict. c. 76), s. 5, sub-s. 5; s. 24, sub-s. (b).*

By s. 24 (*b*) of the Public Health (London) Act, 1891, "any chimney (not being the chimney of a private dwelling-house) sending forth black smoke in such quantity as to be a nuisance" is liable to be dealt with summarily:—

Held, that the funnel of a steam-tug was a chimney within the section.

An abatement or prohibition order is not bad because it does not, under s. 5, sub-s. 5, specify the works to be executed for the purpose of abating or preventing the recurrence of the nuisance, although the person on whom the order is made may have required them to be specified. Tough *v.* Hopkins. Div. Ct. [1904] 1 K. B. 804.

URINALS.—*Power to provide sanitary conveniences—Local government—Public health—Sanitary authority—Subsoil of road—Vesting in sanitary authority—Misuse of statutory powers—Injunction—Public Health (London) Act, 1891 (54 & 55 Vict. c. 76), s. 44.*

By the Public Health (London) Act, 1891, s. 44, sanitary authorities have

power to provide public sanitary conveniences in situations where they deem the same to be required, and to defray the expense of providing the same, and of any damage occasioned to any person by the construction thereof. And for the purpose of such provision the subsoil of any road, exclusive of the footway adjoining any building, is vested in the sanitary authority.

A sanitary authority constructed in the middle of a street (partly in the subsoil belonging to the plts. as owners of a house at the side of the street) underground conveniences, with underground approaches or subways having an entrance on each side of the street by means of a staircase. The subways could be used for the purpose of passage from one side of the street to the other, and were of greater width than was necessary for the purpose of approaches to the conveniences. The sanitary authority had no statutory power to construct subways:—

Held, on the evidence (differing in this respect from Joyce J.), that the primary object of the sanitary authority in constructing the approaches was that they might be used as a subway for passage from one side of the street to the other, and that consequently they had exceeded their statutory powers and ought to be restrained by injunction.

Decision of Joyce J. [1902] 1 Ch. 269, reversed.

Per Vaughan Williams L.J.: *Semble*, that s. 44 does not vest in the sanitary authority so much of the subsoil as could possibly be used for the purpose mentioned, but that if the sanitary authority do in fact use the subsoil for that purpose the subsoil so used vests in them.

Semble, also, that the sanitary authority have not to pay compensation to the landowner for the subsoil which they use. London and North Western Ry. Co. *v.* Westminster Corporation. C. A. [1904] W.N. 67; [1904] 1. Ch. 759.

VIBRATION.—*Noise—Electric generating station—Borough council—Statutory powers—Provisional Order under Electric Lighting Act—Construction of works—Temporary nuisance—Injunction.*

The defts., a borough council, acting under a provisional order, erected an electric generating station in proximity to houses of which the plts. were lessees and occupiers. The order provided that nothing therein should exonerate the undertakers from the action for nuisance in the event of any being occasioned by them. In an action for an injunction it was admitted that the vibration caused by the defts'. machinery constituted an actionable nuisance unless it was excusable upon the ground of being merely temporary. The defts. alleged that the nuisance could be removed in time by experiment and alteration of the machinery; and contended that until the machinery was perfected the construction of their works was not complete, and the action would not lie against them:—

Held, that the nuisance was not temporary, nor were the defendants to be

excused within the principle laid down in *Harrison* v. *Southwark and Vauxhall Water Co.*, [1891] 2 Ch. 409; and that the defts. were not entitled to carry on their works unless or until they could do so without creating a nuisance. An injunction was granted during the continuance of the plts'. leases.

One of the plts. had granted a sub-lease for the remainder of his term less the last three days thereof:—

Held, that he was entitled to an injunction in respect of injury to his reversion. COLWELL *v.* ST. PANCRAS BOROUGH COUNCIL. Joyce J. [1904] W. N. 40; [1904] 1 Ch. 707.

WATER *for domestic purposes—School—Water company—Waterworks Clauses Act, 1847 (10 & 11 Vict. c. 17), ss. 48, 50, 53—Waterworks Clauses Act, 1863 (26 & 27 Vict. c. 93), s. 12.*

The defts., who were the occupiers of a school within the district supplied by the plts., demanded a supply of water for domestic purposes, but refused to comply with the regulations made by the plts.:—

Held, that the school was a dwelling-house within the meaning of the Waterworks Clauses Acts, and that although a business was carried on there the defts. might still be entitled to a supply of water for domestic purposes, but that they must first comply with the reasonable regulations for that supply which the plts. were entitled to make.

Pidgeon v. *Great Yarmouth Waterworks Co.*, [1902] 1 K. B. 310, commented on. SOUTH-WEST SUBURBAN WATER CO. *v.* ST. MARYLEBONE UNION. Buckley J. [1904] 2 K. B. 174.

WATER-CLOSET ACCOMMODATION.—*Lodging-house—Validity of By-law—Public Health (London) Act, 1891 (54 & 55 Vict. c. 76), ss. 37, 39.*

A by-law with respect to water-closet accommodation made by the London County Council under the provisions of s. 39, sub-s. 1, of the Public Health (London) Act, 1891, required the landlord or owner of any lodging-house to provide and maintain in connection therewith water-closet, earth-closet, or privy accommodation in the proportion of not less than one water-closet, earth-closet, or privy for every twelve persons, and a penalty was provided for any offence against the by-law:

Held, that the by-law was unreasonable and bad, because it contained no provision for giving notice of the requirements of the sanitary authority to the person against whom it was contemplated that proceedings should be taken for breach of the by-law.

NOKES *v.* ISLINGTON CORPORATION (No. 1). Div. Ct. (1903) 610.

GENERAL NOTES.

REPORT ON THE EDUCATIONAL CONFERENCE HELD AT BRADFORD, JUNE 30TH TO JULY 2ND.

By Alice Ravenhill.

The Conference assembled for six meetings, in the course of which ten groups of subjects were discussed. Of these, three were directly concerned with hygiene: (1) The physical condition of children and school hygiene, (2) Child study, (3) The need for nursery schools; while in three more the hygienic aspects of the subjects were freely introduced: (*a*) The application of Froebel's principles to the education of boys and girls from five to twelve years of age, (*b*) Co-education, (*c*) The place of handwork in the school curriculum.

Perhaps the most impressive feature of the largely attended conference (3,000 tickets were issued) was the prominence assigned, and repeated reference made, to hygiene in education, including the importance of training all children into habits of intelligent co-operation in sanitary measures by definite instruction in the mechanism and requirements of the body. For example, the Dean of Durham (Dr. Kitchen), when speaking on the "Co-ordination of Schools," referred to the great need "for more thorough school instruction in the moral questions connected with the great social problems of the day, a preliminary to which should be making children understand the thing they live in."

Dr. Kerr (London County Council Education Department) read a useful paper on "The physical condition of school children." He stated that the result of recent and reliable investigation shows that one-third of the children in elementary schools have some kind of undesirable defect. Of these a low percentage are congenital or accidental, a high percentage are preventible; the chief causes being ignorance, dirt, and drink, though due allowance must be made for the results of acute poverty. Adequate ventilation, avoidance of fatigue, suitable and sufficient physical exercise, systematic medical inspection, and the support and assistance of inspectors and well-trained teachers, constitute, in Dr. Kerr's opinion, some of the most important agencies in promoting healthy conditions in schools.

Dr. Hall (Leeds) reported the outcome of his recent investigations on the physical conditions of poor Board School children. He gave full particulars of the gain to such children of one full meal a day, and furnished statistics as to the superiority in height and weight of Jewish as compared with Gentile children, owing to more maternal care and to a more nutritive diet. Dr. Hall advocated the compulsory feeding of children by their parents, even to the taxing of wages for the purpose prior to payment; the State to be responsible where evidence of poverty released parents from this obligation.

Dr. Helen Wilson (Sheffield) gave a report of her physical examinations extending over a term of years, of girls in a large secondary school: sixteen per cent. had errors of refraction; twenty per cent. showed enlarged tonsils or adenoids, and in eleven per cent. hearing was defective. Of 167 girls only forty per cent. had good teeth. Her facts proved the value of medical inspection. Dr. Wilson regretted the indifference of parents on the subject, even when the necessity for immediate remedial measures was laid before them.

Miss Alice Ravenhill (London) pointed out the sociological significance of school hygiene; the hindrance to teachers' efforts which exists in the apathy of parents, and the want of knowledge of local authorities; and the opportunities offered in a well-managed school for grounding all children, equally in primary and secondary schools, in the general principles of hygiene.

At the Conference on "Child Study" Miss McMillan (London) spoke on "Fatigue," giving useful applications in illustration of her points.

Miss Findlay (Southlands Training College) contributed a *résumé* of some enquiries she has conducted with the object of testing mental development, and how it is promoted by school education in children from 8 to 12.

Mr. J. C. Hudson (British Child Study Association) dealt with the necessity for, and assistance from, the application of scientific methods to any study of the health of children.

The meeting on "Nursery Schools" was essentially practical in spirit, and led to immediate results at Bradford. The physiological needs of very young children, and the results of their neglect, were forcibly but moderately discussed by Mrs. Miall (Leeds), Miss Phillips (Inspector, London County Council Education Department), and others. The main points emphasised were: (1) the injurious effects of subjecting "infants" to anything analogous to ordinary school routine; (2) the desirability of arranging suitable rooms and outdoor playgrounds for small numbers under experienced teachers, so long as babies of three to five were received as scholars; (3) the importance of entrusting all "inspection" of young children to suitable women; consequently the immediate necessity of securing the appointment of more women inspectors of schools; (4) the routine engagement of a trained nurse, or a highly qualified attendant, to care for and report on the physical needs of the children.

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CONGRESS AT GLASGOW.

SECTION I.
SANITARY SCIENCE AND PREVENTIVE MEDICINE.

PRACTICAL DISINFECTION IN ROOMS AND WORKSHOPS OCCUPIED BY SUFFERERS FROM CONSUMPTION.

By HENRY KENWOOD, M.B., D.P.H.,
Professor of Public Health at University College, London, and Medical Officer of Health, Borough of Stoke Newington.
(FELLOW);

And F. J. ALLAN, M.D., D.P.H., F.R.S.E.,
Medical Officer of Health, City of Westminster.

IT is in the home and work-room that the bulk of the infection of phthisis is communicated; and seeing that so many sufferers in the earlier stages of disease are unable to cease their work and are unwilling to enter institutions, and that so few in any stage of the disease are able to avail themselves of the miserably inadequate provision of curative institutions in this country, Health Officers recognise the necessity of exercising some supervision and of rendering assistance in respect of the poor or ignorant consumptives at home and in the workshop, where so large a proportion of the sufferers are compelled to pass their time. This is the main argument for the voluntary notification of the disease, and the sooner this measure is made compulsory, the earlier

NOTE.—The Proceedings of the Section commenced with an Address by PROF. JOHN GLAISTER, M.D., D.P.H., F.R.P.S.G. F.C.S., F.R.S.E. (*see p.* 218).

this desirable work will be made as complete as it ought to be. Under the system of voluntary notification, of which we both have experience, many of the more necessitous cases are notified, and the important question of what is the most practicable and efficient scheme of disinfection is one to which we have given some consideration, and the subject is well worthy of discussion at this Congress.

It is important to bear in mind the nature of the disinfection required, because that must necessarily influence our selection of methods. The small room, which is often continuously occupied by the patient, must be regarded as exposed from day to day to a more or less general infection by the bacillus; less when all precautions are taken with regard to the sputum that care and intelligence can dictate to the patient, and more when, as is generally the case, the precautions taken are less complete.

The first importance is always attached to the destruction of the specific bacilli contained in the sputa coughed up by affected persons. For this purpose we are careful to recommend that patients spit into proper receptacles in which the sputum may be kept moist (preferably with a disinfectant agent) until its dangerous properties are destroyed. But even with the most careful patient it is impossible at times to avoid the accidental soiling of floors, walls, or clothing with sputum; moreover, Flugge* has demonstrated that the minute drops of moisture sprayed out by a consumptive in coughing, speaking, and sneezing, may contain tubercle bacilli to a considerable extent, and that such drops may be scattered as far as a distance of four feet from the patient. Ordinary sputum may eventually dry up and be converted into dust, although its tenacious character prevents this to a considerable extent, but the fine spray scattered by violent expiratory efforts may remain suspended in the air for some time,† and in any case must be more rapidly converted into dust (and that of a more minute character) than the sputa.

The tubercle bacillus is a resistant organism, and drying has little effect upon it. Exposed to bright sunshine, Ransome has shown that the organism may be speedily destroyed if unprotected. This has an important bearing upon the question of disinfection, for it is evident that in a well-ventilated, well-lighted house, where care is exercised in regard to expectoration, natural processes will play an important part in destroying the *exposed* bacilli contained in the fine dried spray, and the danger of infection from this cause will be small. On the other hand, in rooms and

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* Zeitschrift f. Hyg. u. Infektionskrankeiten, xxx. 1899.

† Heymann, Ibid xxxviii, 1901.

houses of an opposite description, the dust will retain its infective quality for long periods. This probably explains why it is that so little danger of transmission of infection appears to exist where patients are treated under good hygenic conditions, as in hospitals, and the high degree of infectivity where the opposite state of affairs obtains. The possible existence of this infective dust in rooms occupied by consumptive patients points to the need for disinfection of rooms during the progress of a case, as well as after the rooms have been vacated. It also emphasises the importance of wet cleansing, so that the infected dust may be removed in a manner which will not distribute it throughout the air of the room.

So also in workshops, warehouses, offices, schools, etc., more care seems required than is at present given to secure cleanliness and freedom from dust.

We have therefore to provide, firstly, for the disinfection of the sputum, secondly, for the disinfection of handkerchiefs, pillow-cases, sheets, etc., and thirdly, for the frequent collection and removal of the dust which gathers upon the horizontal and other retentive surfaces of the room.

It is by no means an easy matter to decide upon the best disinfectant to employ, and in making our selection many considerations have to be weighed together. It is desirable to use one disinfectant if possible for all three of the above mentioned purposes, and it is necessary that this disinfectant should be efficient, cheap, non-destructive of textile articles, etc., of a pleasant nature (if at all odorous), and incapable, when some of it passes into the general atmosphere of the room, of proving in any way irritating to the very sensitive respiratory organs of the sufferers. Furthermore, one has a natural reluctance to employ a disinfectant of a markedly poisonous nature when regard is had to the circumstance that it is often necessary for young children to spend much of their time in the sick room, and that food is often stored and prepared, as well as consumed therein. It will be recognised that solutions of carbolic acid (1 in 20) perchloride of mercury (1 in 500), chloros (containing 2 per cent. of available chlorine) and formic aldehyde (2 per cent.), though efficient disinfectants, do not meet the requirements above specified, and we accordingly selected Izal—a disinfectant which both of us have used for several years with entirely satisfactory results.

Izal is practically non-poisonous, it gives off an odour which is quite free from irritating effects, it does not injure textile articles to which it is applied (as chlorine disinfectants do), and its very considerable powers as a disinfectant have been attested by a large volume of experimental evidence.

The extent to which various disinfectants retain their strength after prolonged exposure has not, we believe, hitherto been the subject of any careful investigation. This aspect of disinfectants is, however, a most important one when we consider the length of time for which a disinfectant may be kept before use, and, still more, the time which frequently elapses between its dilution with water and its application to the place or material to be disinfected. Many disinfectants, which are very efficient when freshly mixed, partly or entirely lose their power after even a short exposure. Izal, which is thought highly of by both of us, contains as its active constituent an oil of high boiling point, and would therefore seem likely to stand exposure well. This is amply borne out by the following experiments, in which we included cresol saponatum, chiefly because it contains 50 per cent. of tar cresols dissolved in a soap, and is a type of a numerous body of disinfectants.

The writers wish to acknowledge the valuable assistance of Dr. A. C. Stevenson, Demonstrator in the Bacteriological Laboratory at University College, London, in these experiments.

In the exposure experiments undertaken, dishes containing 200 c.c. of certain disinfectants, each made up to a uniform dilution of 1 in 100, were exposed for four weeks. The disinfectants employed were izal, phenol (B.P.), chloros, Condy's fluid, and cresol saponatum, and a sample of each was purchased in the open market. The dishes and their contents were kept in a closed cupboard (temp. 55°–67° F.). The loss from evaporation was made good with distilled water every four days, and at the end of four weeks the germicidal strength of 200 c.c. of the exposed liquid was tested upon a growth of B. typhosus.

The culture of B. typhosus employed was one which is kept in the laboratory for Widal's reaction, and which was originally isolated by Dr. Milburn at the Middlesex Hospital laboratories.

The broth used was that in ordinary use in the laboratory, being made from Lemco., and requiring 10 c.c. of normal soda to make it neutral to phenolphthalein. Five c.c. were used in each tube. Five c.c. of the disinfectant to be tested were placed in a sterile test-tube, and to this were added 5 drops of a 48-hour culture of the organism in broth. The 48-hour culture at 37° C. was chosen, as, according to Rideal and Walker, it is more resistant.

Inoculations were made at intervals of five minutes up to half-an-hour, and control cultures were made both from the disinfectant and from the culture. In all instances two loopfuls of the mixture of disinfectant and broth culture were used. The broths were incubated at 37° C. for at

least 48 hours, and where growth was absent the incubation was maintained for 72 hours.

In cases of doubt, sub-cultures were made from the broth on agar and films were made.

The carbolic acid employed was the acidum carbolicum liquefactum of the British Pharmacopœia and this was found by titration with bromine to contain 90·9 per cent. of pure phenol.

The results are shown in the accompanying table :

Disinfecting action of certain solutions, after being exposed for four weeks to the air, upon B. typhosus.

Solutions exposed.	Dilution.	Time culture exposed to action of disinfectant, minutes.						Controls.	
		5	10	15	20	25	30	Cultivation.	Disinfectant.
Phenol (90·9 per cent.) ...	1 in 100	+	+	+	+	+	+	+	—
Condy's Fluid	„ 100	+	+	+	+	+	+	+	—
Cresol Saponatum ...	„ 100	+	+	+	+	+	+	+	—
Chloros	„ 100	+	+	+	+	+	+	+	—
Izal	„ 100	—	—	—	—	—	—	+	—
„	„ 150	—	—	—	—	—	—	+	—
„	„ 200	—	—	—	—	—	—	+	—
„	„ 300	—	—	—	—	—	—	+	—
„	„ 400	—	—	—	—	—	—	+	—
„	„ 500	—	—	—	—	—	—	+	—
„	„ 600	—	—	—	—	—	—	+	—
„	„ 700	—	—	—	—	—	—	+	—
„	„ 800	—	—	—	—	—	—	+	—
„	„ 900	—	—	—	—	—	—	+	—
„	„ 1000	—	—	—	—	—	—	+	—
„	„ 1100	+	+	+	+	+	+	+	—
„	„ 1200	+	+	+	+	+	+	+	—
„	„ 900	—	—	—	—	—	—	+	—
„	„ 1000	—	—	—	—	—	—	+	—

These experiments serve to demonstrate that after considerable exposure izal retains a disinfecting power upon the B. typhosus, which is at least 10 times that of 90·9 per cent. phenol. We found that the fresh phenol solution diluted to 1 in 100 required at least 10 minutes' exposure to disinfect, and from the table it will be seen that the exposed disinfectant failed to disinfect after even 30 minutes. Thus there is very little, if any, loss of power on the part of exposed izal, whereas the loss is very considerable in the case of phenol, and the superiority of this disinfectant in this respect over chloros, Condy's fluid, and liquor cresolis saponatum is also very marked.

The slight browning which may be noticed on exposure of izal is clearly

not a change which causes a reduction in the disinfecting powers of this agent.

Dr. E. Duncan, M.D. (Glasgow), judging from his experience in phthisis and his knowledge of the etiology of phthisis, considered the disinfection of houses in which phthisical patients had lived and died to be a matter of very great urgency. Unfortunately, there was frequently much inactivity in the matter on the part of the authorities. Many instances could be quoted from the experience of ordinary practitioners as to the desirability of disinfection of premises in order to minimise the risk of infection. A phthisical patient in hospital was found to have come from a house where there was a sister dying and another sister seriously ill. Within one year four sisters died of phthisis pulmonalis in that house, but the lad who came to hospital recovered and went abroad. Previous to the occupancy by that family there had been several deaths from phthisis in that house, so that it was an infected house when they entered it. Surely in such a case as this, disinfection of rooms was urgently needed. He could mention another case, that of a mason, who had had phthisis for two years before he went into hospital. On inquiry it was discovered that both his wife and daughter were suffering from the same disease, due no doubt to infection, and both died before the original patient. These and many similar facts showed conclusively that the question of infection had an important practical side, and he was glad it had been taken up by that section, by Professor Kenwood, in whose remarks he had been greatly interested.

Dr. Leslie Mackenzie (Edinburgh) said that in actual practice he had found that izal had a disagreeable effect on articles of clothing, which, after being steeped and boiled, developed spots not unlike iron-rust stains. Great care had to be taken in making the solution, and he recollected a case in which undissolved izal had been applied to a batch of clothing with disastrous results. He therefore asked how Professor Kenwood proposed to apply this disinfectant, whether by spraying or by washing, as he took it for granted that mere exposure was quite useless. Information on the practical method would be valuable to all health administrators. Koch, it would be remembered, was of opinion that in phthisis personal infection played the chief part in tubercular infection, and he had no doubt that was so.

Dr. A. Newsholme (Brighton) explained that one of his objections to the use of izal was the disagreeable smell afterwards. When death had taken place through phthisis, thorough disinfection must be carried out, whether agreeable or otherwise, but during the progress of the case the greatest care should be exercised so as not to render the patient a source of

inconvenience to others. This was an absolutely necessary condition, even for the sake of others, including those attending upon the sick. Above all, they should guard against any tendency to make lepers of their phthisical patients. After all, he was of opinion that wet cleansing was in the majority of cases sufficient in the way of disinfection, and the less they depended on chemical preparations the better. Hence they should try to get to the bed-rock of the whole matter, cleanliness.

Dr. S. G. Moore (Huddersfield) explained that he had what might be called a constitutional objection to using a proprietary article, and his reasons were twofold. In the first place it was difficult to discover actually what the proprietary article was composed of, although that might not be the case with izal, and in the second place it was not always easy to be convinced of its efficiency. Some year and a half ago a large pattern-weaver's room was reasonably suspected of being infected with tubercle bacilli. Out of sixty men employed five had been attacked with phthisis, and it fell to his duty to disinfect the rooms in which there were looms and machinery. Obviously no corrosive vapour could be employed, and the work of the mill could not be stopped. The method he adopted was to have the walls lime-washed, the looms were thoroughly cleaned with soap and water (a solution of soap being employed) and the floors were treated in the same way. The happy result was that no fresh case of the disease made its appearance. Up to the present he had been able to avoid the use of proprietary disinfectants, which had been frequently urged upon him, and he always advocated heat and cleanliness as the greatest and best disinfectants.

Dr. J. F. J. Sykes (St. Pancras) asked why it was that in the experiments set out in Dr. Kenwood's paper as to the disinfecting action of certain solutions the bacillus typhosus had been chosen to be acted upon and not the bacillus tuberculosis? He suggested that this point was of considerable importance, as the discussion had started upon the question of the disinfecting power of Izal on the tubercle-bacillus, as he understood the remarks which had been made.

Dr. J. Knight (Glasgow) pointed out that that city had been extremely unfortunate in being attacked by two outbursts of plague, and perhaps never before in the history of local sanitary authorities were the rooms of a medical officer of health more besieged by travellers advocating the merits of their various preparations. It had been his sad lot to interview those gentlemen, and in connection with that experience two things had struck him forcibly. The first was the profound ignorance of those commercial representatives of the chemical composition of the sovereign remedies they advocated, and the second was the strong smell of most of their preparations. The second fact seemed to appeal strongly even

to these representatives themselves. He agreed with Dr. Newsholme and Dr. Moore in advocating the liberal use of soap and water, and in the efficacy of greater cleanliness as a disinfectant, and he found that these measures were good enough for himself. In Glasgow, leaflets were issued containing in popular language information regarding the cause of consumption and the simple methods to be adopted for the prevention of its spread. During the course of phthisical illness, disinfection was carried out by the local authority on application at repeated intervals. In the case of death, complete disinfection of the apartment and infected articles was carried out. He thought that when a particular disinfectant was advocated there was a tendency for people to trust too much to it, at the same time neglecting common sense and ordinary precautions, such as scrupulous cleanliness and fresh air. This was really his objection to the even undesigned booming of any special disinfectant or preparation.

Dr. H. Scurfield (Sheffield) said that at Sheffield a register was kept of all cases of phthisis. To these cases the inspectors of the health authority made regular visits, gave advice, and where necessary supplied spittoons. These spittoons were wide-mouthed flasks with rubber stoppers, and were made flat so as to fit easily into the pocket. They had now been used at Stanhope Sanatorium for two years with great satisfaction, and there was the added advantage that they were exceedingly cheap, being only 4½d., whereas they had originally been paying as much as 2s. 6d. for a patent flask. The health inspectors recommended the opening of windows and other ordinary precautions, and their experience was that the people were quite ready to carry out their instructions. During the late stage of the disease, the bed-ridden stage, disinfectants were used, the patients being removed from their bedroom for a few hours, and a solution of formic aldehyde being employed in the form of spray. With these and other measures they were attempting to combat the disease of phthisis, which in Sheffield was compulsorily notifiable under a local Act, but these provisions had not yet been in force a sufficient time to judge as to results.

Dr. E. M. Smith (York) briefly explained the system of voluntary notification in existence in that city.

Professor H. R. Kenwood (London), in replying, explained that what he and Dr. Allan had wished to bring out by their paper was that izal was in their opinion and experience the most serviceable disinfectant for general use. A bacteriologist would readily understand why the *B. tuberculosis* had not been employed in the experiments mentioned. Had this organism been used instead of the *B. typhosis*, several months would have been required to complete inoculation experiments and obtain results. What his colleague and himself were anxious to determine was whether izal retained its disinfectant action after exposure, and it really did not

matter which bacillus was used to demonstrate that. He agreed with Dr. Leslie Mackenzie that izal might damage clothing unless care were taken, but after all that was no great objection, since it could be obviated by attending to simple directions. Of course, he did not in any way claim that izal was in every respect perfect, but that it compared favourably with other disinfectants in common use. As to the method of employing it, Dr. Allan and himself had used a solution of 1 in 50 for sputum, and 1 in 100 for rooms and for wet dusting. With regard to the question of odour, he could say that he had distributed izal for four years where there was a system of voluntary notification, and there had never been a complaint. Personally he found it a pleasanter compound than carbolic. As to Dr. Moore's disinclination to deal with proprietary articles, all he could say was that to take up a rigid attitude of that kind was to preclude the use of some valuable agents. Although izal was a proprietary article, it was an exceptionally good one. He held no brief for it, and had simply been led to experimentally consider it solely from the excellent results it had yielded in the hands of a large body of experimentors. Personally, he was in perfect accord with Dr. Newsholme when he said that it is desirable we should aim at greater cleanliness and a more liberal use of soap and water; but then that would not altogether satisfy public opinion nor the opinion of the medical profession generally if these were solely relied upon for disinfecting purposes. They might, in fact, just as reasonably say that only soap and water should be employed after smallpox, for there could be little doubt that the smallpox-virus was more easily destroyed than the tubercle-bacillus.

On a motion for the Compulsory Notification of Phthisis—

Dr. E. Duncan (Victoria Infirmary, Glasgow) said he took it that they were all agreed that voluntary notification of phthisis was desirable, and he knew that where it had been instituted properly it had been followed by most beneficial results. It had led to patients themselves discussing and investigating under what conditions phthisis pulmonalis arose, and to their taking greater interest and care in the matter of personal cleanliness and the disinfection of their homes. But he thought the movement ought to go further than this. Action such as he suggested might lead to the provision of municipal sanatoria for the treatment of those patients, and personally, he thought such special hospitals or sanatoria ought to be rate-maintained. The early stages of the disease inevitably led to chronic pauperism in the later stages, and if patients in the early stages could be got hold of there would really be an enormous economic and financial gain to the community. Patients in the intermediate stages should be supervised. In the course of his experience he had come in contact with many cases of workmen and clerks suffering from phthisis, and he had never heard of any objection being made either by their employers or by those beside whom they worked from day to day to the necessary precautions it was deemed desirable to take. Undoubtedly it was during the last stage of the disease that there existed the greatest danger of

infection, and it was, he contended, the bounden duty of the community to do something to protect itself against that obvious danger by erecting hospitals for hopeless incurable cases.

After some discussion on the form of the resolution and the advantages to be gained by notification, in which Prof. H. E. Clark, C.M.G., Dr. R. Laurie, J.P., Councillor J. T. Biggs, Dr. A. Newsholme, Dr. S. G. Moore, Dr. W. Butler, Councillor J. Cameron, Dr. W. Arnold Evans, Dr. S. Barwise, and Prof. Glaister took part, the resolution was carried by 85 votes to 11 in the following form:—"That in view of the prevalence of pulmonary tuberculosis among the population of Great Britain, and of the suffering, pauperism, and death resulting from the dissemination of that disease, this Congress recommends the Council of The Sanitary Institute to memorialise the Local Government Boards of England and Scotland to allow local health authorities to add pulmonary tuberculosis to the schedule of notifiable diseases on such conditions as may be approved by the Local Government Boards."

NOTES FOR A DISCUSSION ON THE CAUSE OF SMALLPOX.

By J. JACKSON CLARKE, M.B.Lond., F.R.C.S.Eng.

A DISCUSSION must begin on some definite basis, and I would propose that we begin with two assumptions :—

First, that the immediate cause of smallpox is a living organism; and second, that the same living organism that causes smallpox also causes vaccinia.

It remains to sift what evidence there is that the *contagium* of smallpox may be a member of the vegetable or of the animal kingdom. Personally I know of no valid evidence to show that any particular bacterium or other fungus has a causal relationship to smallpox. Many kinds of bacteria have been found in the contents of smallpox lesions and in vaccine, but not one of them has proved on investigation to have anything to do with originating the disease, although when once the disease has been set up some of the bacteria present influence the course of events very seriously; thus, as far as I remember, most of the fatalities in smallpox are caused by the common streptococcus pyogenes, but no one thinks of that organism as the cause of the disease. Able bacteriologists have from time to time isolated a new bacillus in variola or vaccinia, but when isolated all these bacteria have failed to reproduce the disease on being inoculated into animals. It has been found that two substances, glycerine and, more recently, chloroform, that are known to repress bacterial life, have, within certain limits, no destructive effect upon the causal agent of vaccine.

Moreover, lymph from smallpox lesions and specimens of vaccine that have been subjected to every known cultural and microscopical test, and that have thus seemed to be free from bacteria, have been found to be capable of causing vaccinia when inoculated into animals. Unless some new facts have been disclosed, we have no evidence that smallpox is caused by bacteria.

In view of the first assumption that, for the sake of rendering a discussion possible, I asked you to allow me to make, my next point is the evidence in favour of the cause of smallpox being a protozoon. Since 1892, when Guarnieri made his now famous observations on the histological changes that follow vaccination of the cornea of rodents a good deal of evidence in this direction has accumulated. Most of us are now familiar with the very striking changes that Guarnieri described, and that a considerable number of subsequent observers have confirmed; the salient features I show you under the first three microscopes, and in the first three diagrams. The facts may be stated almost as Guarnieri first described them, a little amplified by the findings of subsequent observers, as follows: If lymph, whether from a smallpox lesion or active vaccine be placed in a small pocket, or, what is perhaps better, a clean, straight, shallow incision across the cornea of a rabbit, guinea-pig, or calf, certain changes follow within 48 hours:—

1. A thickening of the epithelium at the point or line inoculated.

2. A slight loss of substance at the middle of this thickening which meanwhile is extending outwards. Guarnieri's original illustrations of the bodies in smallpox and in the variolated are reproduced in Fig. 1, A and B.

Fragments of the epithelium of the thickened zone examined under the microscope in the fresh state present in most of the cells small bright bodies lying for the most part in depressions at the periphery of its nuclei. In stained sections of well prepared corneæ (up to the seventh day in guinea-pigs' corneæ, J. J. C.) the bodies are seen to take both basic dyes, such as methylene blue and hæmatoxylin, and acid dyes such as eosine and fuchsine. They stain fairly well with the common acid hæmatoxylin and eosine method as seen in some specimens which I made ten years ago. The bodies thus stained resemble in physical properties hyaline substance, they also resemble physically the bodies that occur in cystic ureteritis and that are by some believed to be protozoa. They also resemble some stages of the common gregarines of the cockroach. At the end of the 48th hour, they are larger near the seat of inoculation than at the outer limit of their extent. Not only are they larger, but some of them present a central clear space; others, again, in this central space contain one or more granules that stain with the elective reaction of chromatin; others have assumed amœboid shapes. The outer extent of the infiltrating bodies in the corneal cells is rather sharply defined. At this outer limit some of the bodies appear to be

DESCRIPTION OF FIGURES.

1. A. Cells of the mucous layer of the human epidermis in section of a small-pox lesion. Each cell shows the degeneration of nucleus and perinuclear plasm characteristic of the prepustular stage, and each contains in its cytoplasm a small dense body.

1. B. Cells of the epithelium of a section of a rabbit's cornea two days after inoculation with small-pox lymph; many of the cells contain small dense bodies similar to those seen in the small-pox lesions.

2. *a.* A cell from a section of a small-pox lesion; three gemmules are present in the cytoplasm close to the nucleus.

b. A cell containing an older gemmule in the cytoplasm.

c. A cell containing a large amœboid parasite in the cytoplasm.

d. A cell containing an amœboid parasite in process of gemmule-formation, and, above, a round dense body, probably a microgametocyte.

e. A cell containing an amœboid parasite in process of gemmule-formation; some of the gemmules are escaping into the cytoplasm.

l. A cell, the nucleus of which contains five spores and three secondary sporoblasts developed from spores; there is one spore in the cytoplasm.

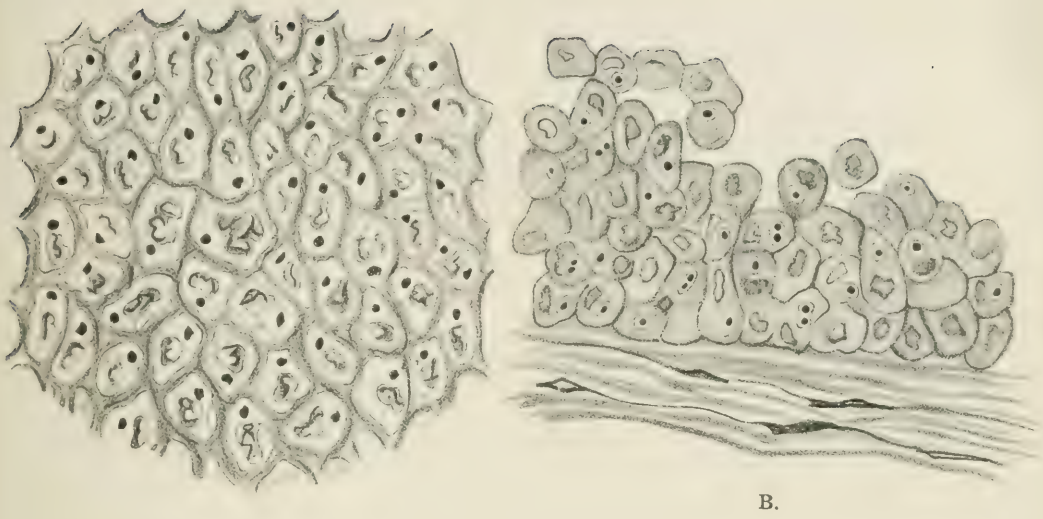
m. A cell, the nucleus of which contains secondary sporoblasts.

n. A cell, the nucleus of which contains a reticular sporoblast, with spores, some of which have escaped from the meshwork.

o. A cell, the nucleus of which has been replaced by a large sporoblast, from which some of the spores have escaped into the cytoplasm.

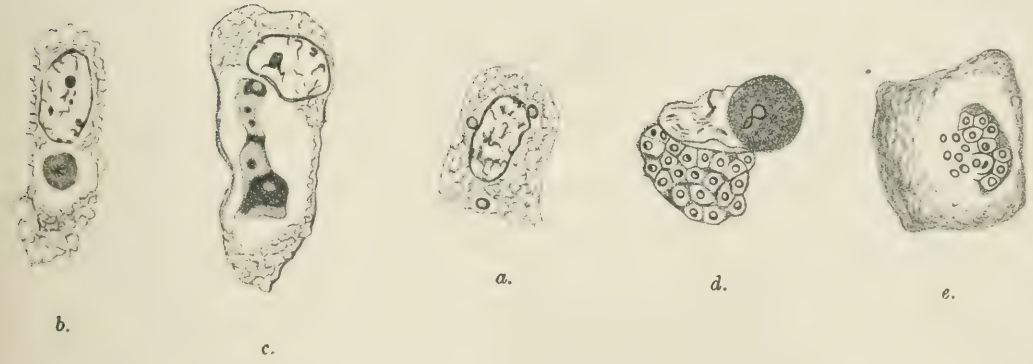
FIG. 1. Is copied from Guarnieri's original article: "Recherche sulla pathogenese ed etiologia dell' infezione vaccinica e variolosa."—*Arch. per Sci. Med.*, xxvi., p. 403.

FIG. 2. Is copied from the coloured plates illustrating G. N. Calkin's section of "Studies of the Pathology and on the Etiology of Variola and of Vaccinia," published by the *Journal of Medical Research*, 1904.

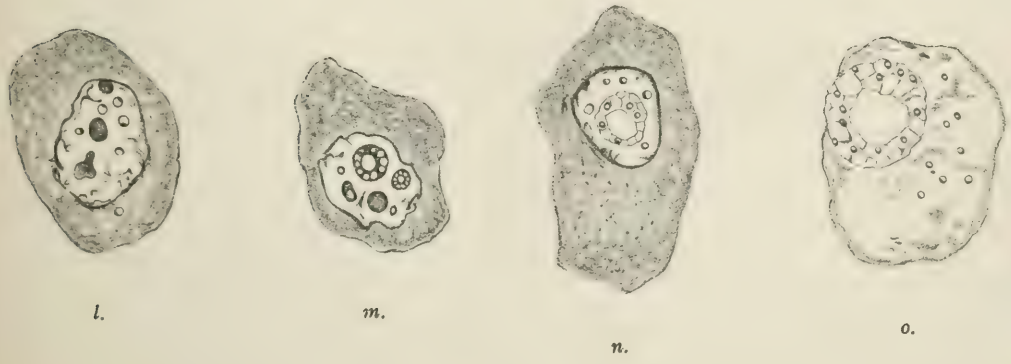


A. B.

FIG. 1.



b. c. a. d. e.



l. m. n. o.

FIG. 2.

Bale & Danielsson, Ltd., Lith

dividing into two equal parts. Other forms that suggest subdivision occur, *e.g.*: intracellular clusters of more or less morula-form; and lately Councilmen Magrath, Brinkerhoff, and Calkins in America, have described other forms to be referred to below. The above include the salient histological features of the vaccinated cornea. It remains to inquire into the interpretation of the phenomena which have been established.

Controls.—Before proceeding to discuss the nature of these bodies, we must ask whether:—

1. There are structures like them in the normal cornea.

2. They may be mechanical foreign bodies.

3. They may be degenerated parts of the cells themselves, a special degeneration whether of centrosome, nucleus, or cytoplasm resulting from the action of an unknown virus.

4. They may be derived from leucocytes or other wandering cells.

5. They may be bacteria, or allied organisms.

These points have been fairly fully looked into, without providing any sound explanation of Guarnieri's bodies.

If a full examination of these questions gives a negative result, and we may thus presume that they are protozoa, the question arises, to what class of the protozoa do they belong? Calkins places them nearest to the microsporidia. Calkins believes that in variola these bodies are parasites, and the difference between vaccinia and variola consists in this: that in the former they have only a cytoplasmic habitat and a vegetative (multiplicative) process of reproduction, whilst in addition to this in variola there is an intranuclear stage where probably sexual interchange followed by sporing (propagative reproduction) occurs. I have been able to recognise the chief forms that Calkins and his co-workers have described. Some of the various forms figured by Calkins are reproduced in Fig. 2, A to E, and L to O. They are very abundant in the lesions, and I have been able to identify the later sporing forms with bodies I saw in smallpox tissue ten years ago. The earlier intranuclear forms closely resemble those structures to which in 1895 I drew attention in a typical alveolar sarcoma, and suggested that both they and the parasites of variola probably belonged to that sub-division of the protozoa called *Suctoria*, many of which are intranuclear parasites. Now the life-history of the parasitic suctoria appears not to have been worked out by biologists, but in an allied group of the *Infusoria* (Colpoda), Rhumbler with great care observed the formation of sporocysts and spores,

and the development of these spores by stages; first amœboid, then flagellate, and finally ciliate. From Rhumbler's description and figures I still think we may have to do with Suctoria in small-pox and other diseases. The chief features on which those who from the study of the variolated or vaccinated cornea and comparison of it with smallpox lesions have come to the conclusion that the bodies are protozoa and the cause of smallpox may be enumerated:—

1. They are so far specific to variola and vaccinia that their appearance after inoculation of a cornea is the best test of the activity of vaccine lymph; and, an important practical fact, their appearance in an epithelium of a test-animal may be used as an aid to diagnosis in doubtful cases.

2. They have been cultivated in a long series of corneæ and from the last a clinically typical vaccination of a child has been done.

3. If they were the products of a degeneration peculiar to variola, then the outcome of connected serial observations would be to show that there are products of degeneration which from day to day undergo a regular growth and development, with numerical increase, and changes in structure; such changes being, in any number of similar observations (vaccination and examination of tissues at stated periods in sequence) constantly repeated and at corresponding periods of time. If we imagine a process akin to crystallization to underlie the phenomena, it may be objected that amœboid movement has been described in them by competent observers, and that no known crystals or crystalloids behave as they do. Additional observations on mobile bodies in vaccinia and variola are still to be desired. Assumed that they are protozoa, and that we are justified in using the term "Cytoryctes Variolæ" (Guarnieri), it yet remains to prove that they are the cause of the disease.

At present artificial cultures are out of the question as is the case in malaria: the knot cannot be cut by Koch's postulates. As in typhoid and other bacterial diseases, other methods of proof must be considered. The organisms as seen in the cornea, and as they have been recently described in variolous tissues, are only seen in the developing lesions; they disappear when local immunity is produced. I am among those who believe that the cytoryctes are the cause of smallpox, but in inviting a full discussion of the various points raised, I may express my belief that it is only by close and leisured personal study both of vaccinia, variola, syphilis, sarcoma, cancer, etc., on the one hand, and of what is known of the protozoa and cell-structure generally on the other hand, that a definite opinion can be formed.

Dr. W. Grainger Kerr (Glasgow) said that to the general biologist the paper would be one of very great interest, and it was one which fitted in with numerous other researches which have recently been carried on in connection with various diseases of animals. These researches had shown that these particular diseases were not in all probability due to any vegetable parasite, but to a protozoon, a very small kind of animal parasite. Of course the most startling feature about Dr. Jackson Clarke's view was that the supposed parasite in this case belongs to the group of so-called Suctoria, or as they were sometimes called the Acinetina. The startling point about this lay mainly in the fact that these organisms are, so far as we have known hitherto, not at all parasitic in habit, but all free living, so that *a priori* we should hardly expect to find such definite parasitic forms among them. But, on the other hand, it had been found that the free living Suctoria carry on a mode of life which might be said to prepare them for parasitic existence, because there are forms of each, although they are not parasitic, living on other free-living protozoon organisms; they catch these organisms and draw out the contents of them through the curious suctorial process that they have, so that it might be said that they are fitted to eventually take on a completely parasitic existence. One of the points to which he presumed further research would have to be directed was in regard to these structures projecting from the parasites, which look like the suctorial process of the body of the Acinetinaria; to the non-specialists these processes rather suggest the nuclear process in a great many different kinds of protozoa. With the Achromatin the rays tend to swell out at their ends, to have little nodules on them, which are really not the suctorial process, but little nuclear substances which are segregating together with the view of subsequent, perhaps, spore formation or some other kind of reproduction. Generally, however, he wished to accentuate the very great interest of the work carried on by Dr. Jackson Clarke, and the curious way in which his original work had been reassisted by various modern research.

Dr. J. Brownlee (Belvidere Hospital) said that, although he had worked at the subject, when he saw the exhibits which had been referred to he had felt more or less of a novice in the matter. But there were one or two points regarding the clinical manifestations of smallpox in their relationship to the life-history of its parasite which he desired to consider briefly. In the first place, the protective nature of the vaccinal process was of a kind which afforded no analogy as far as he knew among bacterial diseases. No matter how a bacterial virus may be attenuated for use as a vaccine, there was always the danger of return to its initial virulence. Out of countless generations of lymph, however, there was no evidence that smallpox had ever been reproduced. In the second place, vaccination protected chiefly against the second stage of smallpox, to which its clinical appearances bore a close resemblance. As the immunity conferred by vaccination died out, the renewed susceptibility to small-

pox was first observed with regard to the initial fever. A person might have a most severe initial fever, and present the appearances of developing an acute attack of smallpox, yet within the twenty-four hours all symptoms might subside, and two or three papules represent the whole subsequent portion of the disease. It would thus seem that we were dealing with an organism which had two stages in its life history in which two different kinds of poisons are elaborated. In the second stage of smallpox, namely, that stage characterised by the development of the eruption, the poisons produced were apparently very closely allied to those produced by vaccination, a fact evidenced by the more complete protection afforded against this stage by vaccination, and also by the similarity of the febrile course shown in the development of both diseases. In the first stage of smallpox the parasite clearly elaborates somewhat different toxins, against which vaccination has a much less lasting protective effect than against the fever of the true eruption. Again, in the case of inoculated smallpox, the first febrile period corresponds closely in its relationship to the development of the inoculated papule, thus corresponding with the vaccinal fever on the one hand, and a mild second stage of true smallpox on the other. While this is subsiding the onset of the true initial fever of smallpox occurs, most frequently with great severity, and this is followed as a rule by an abortive secondary stage, thus illustrating again the fact above stated that the toxins produced in the first and second stages of smallpox are considerably different, and the production of immune bodies in the organisms by the inoculation of smallpox in the skin is chiefly as regards the skin stage of the disease. In this connection Dr. Copeman's demonstration that inoculated smallpox can be made the means of transition between true smallpox and vaccination is especially interesting. There was another clinical point which made somewhat against a bacterial causation of smallpox, and that was the entire absence of infectivity exhibited during the incubation period. Diseases, such as diphtheria or enteric fever, were occasionally found to infect during this stage. During the recent epidemics in Glasgow, however, they had had case after case of persons employed in public places up to the day before sickening, yet no other case was traced to infection from them. This presented a somewhat close analogy to the stage of yellow fever and malarial parasites which is passed in the mosquito. This stage occupies a definite number of days, and although the mosquito may have bitten a person suffering from these diseases, his bite does not infect others until sufficient time has elapsed for the parasite to pass through a complete stage in its life history. Then again, bacterial diseases, *e.g.*, erysipelas, enteric fever, and diphtheria, for instance, run a quite indefinite clinical course, and there is nothing analogous among them to the almost absolute uniformity displayed by the initial fever in smallpox, which resembles much more closely in definiteness the malarial paroxysm. He had shown in the demonstration-room a few sections of what occurs in the hæmorrhagic form of smallpox in which there was evidence of parasite inside the cells, as has been shown by Dr. Clarke. With regard to Prof. Calkins' work, he had been able only to follow a part of his

observations, but he was very doubtful whether it could be taken as at all likely that both stages of the life history of the smallpox parasite occur in the eruption in the skin in cases of smallpox, and only one of these in vaccination. It was much more probable, as he had tried to show in his preceding remarks, that if there were two stages in the life-history of the parasite, one must be associated with the initial fever and the other with the eruption in the skin. Vaccination thus presents half of the life-history of the smallpox organism, or, in other words, the parasite by being introduced into the skin has lost the habit of completing its life-cycle. There are analogies to this among the lower algæ which, when grown experimentally under certain conditions, can at will be deprived of either half of their life-cycle. The only other theory which appeared to him to present a possible solution of the relationship of vaccination to smallpox was that the latter was a symbiotic disease, the result of two organisms acting together, the one more or less dependent for its existence on the other. If one was protected against by vaccination, then the combination is also protected against. He thought he had invented that theory, but he found it to have been put forward as far back as 1876 by Prof. Simpson, of Calcutta. In favour of this, however, in all the work he had done, he had found absolutely no evidence.

Councillor J. T. Biggs, J.P. (Leicester), noticed that it was laid down as a proposition that the immediate cause of smallpox is a living organism, which was also found in vaccine-lymph. That proposition had not been dealt with by the speakers who had taken part in the debate. He had wondered whether that would be done, and whether Dr. Jackson Clarke had read what Professor Crookshanks had said, because apparently the results of his investigation appeared to differ entirely from the conclusions of the author of the paper. Professor Crookshanks had said that he felt convinced the profession had been misled by Jenner and the reports of the National Vaccine Establishment, and for want of true knowledge concerning the nature of cow-pox. Professor Crookshanks had also said that inoculation of cow-pox could not have the least effect in affording immunity from smallpox, as there was no affinity between them. As far as he could gather from the remarks of Dr. Brownlee, the view of that gentleman was that vaccination protects against only one stage of smallpox. What was the practical issue of the address which had been given to them by Dr. Clarke? If the object were to prove that there is a close affinity between vaccination and variola, he did not think the author of the paper or the subsequent speakers had proved anything of the kind. The researches of Professor Crookshanks, whom he thought they would all admit was an eminent bacteriologist, went in the opposite direction. Recent observations had been made in the outbreak at Leicester, and the medical officer of health had formulated certain conclusions which had been spread broadcast throughout the country. But some very important elements had been left out of consideration in the report which had been published, and the introduction of those elements would, to a large extent,

have modified the conclusion which had been arrived at, and to even a limited vaccine protection from smallpox.

The President (Professor Glaister) said that if he might offer one word on the subject, he would start with the fact that there is such a disease as smallpox. Nobody doubted that, even in Leicester. From that he would go to his second fact, viz., that it is in Leicester, where they vaccinate for smallpox, that the same gentleman who had just been quoted by the last speaker, having made some previous observations on smallpox, was in the habit of vaccinating and re-vaccinating all who had dealt with those who had smallpox. From this he was compelled to conclude that there must be some relation between the protective effect of vaccination and the outbreak of smallpox. He had always believed, and believed now (and was bound to believe it the more he knew the facts) that as a matter of fact after re-vaccination one can confidently enter a den of smallpox as morally certain of escaping the disease as of anything that one can be morally certain of in this life. But he went a stage further; the issue between Dr. Brownlee and the other speakers and Dr. Jackson Clarke seemed to be a very narrow one. He did not know why it was that his friend, Dr. Brownlee, confined himself to that adjective "bacterial" all the time—bacterial origin. Dr. Jackson Clarke did not take so narrow a line as that, but spoke of some parasite "of a more particularly protozoic form of organism" in connection with smallpox. Perhaps Dr. Brownlee had not expressed his full meaning, but they might take it that he meant parasitic. If anybody a few years ago had said that malaria was a parasitic disease he would have been considered a hare-brained lunatic, fit only for an asylum. But in ten years it had been proved that not only was malaria a parasitic disease, but the life-history of that hæmatozoon had been written out in every particular. They might therefore be reasonably prepared for some such revelation as this in regard to smallpox. He was not a prophet nor the son of a prophet, but he felt bound to think that the next ten or fifteen years would bring considerable revelations, not only with respect to sarcoma, upon which Dr. Clarke had spoken, but also with respect to carcinoma and many other diseases. He believed we were on the verge of a discovery, possibly of a parasitic and likely of a protozoic character. We still knew very little about the infinitesimal, and the infinitesimal might apply more broadly than in the present instance. He was not prepared to take all his knowledge of the protozoa, and particularly in relation to smallpox, from Prof. Crookshanks. He was bound to say there had been prophets since Prof. Crookshanks. He would further make the suggestion that whatever parasitic mischief exists in smallpox there is no doubt at all that parasitic mischief does exist. He did not think there was any disease in which the incubation period was so certain as in smallpox. They could calculate upon the average that the incubation period was fourteen days, some said fourteen days more or less, or say seventeen. The average experience was enough, and that was that the incubation period of small-

pox was fourteen days. Formerly, in the old days of virulent small-pox, it left its mark; now we had so modified it by vaccination that we scarcely knew it when we saw it. If smallpox remained with us because we did not recognise it and had brought about its non-recognition, and had so moderated the disease that we could hardly distinguish it, the sooner we knew something about its parasitic character the better. Then we might try and scotch it.

Mr. Jackson Clarke, in reply, thanked the President and Prof. Grainger Kerr for their remarks. He believed that Dr. Brownlee had meant to support him, for which support he was much obliged; but by the use of the word bacterial he had been misunderstood. Dr. Brownlee was contrasting the diseases caused by bacteria, such as the typhoid bacteria, vegetable parasites, with those such as malaria, which are caused by animal parasites, and, as the President had suggested, it was very desirable that these diseases should be studied in their pathological aspect. Take a person suffering from ague, his blood might be examined a hundred times without finding the parasite. If he was not examined when his temperature was at its height the parasite breaks up into other forms, and the same thing might happen with smallpox. We had not yet thoroughly investigated this disease, and were only at the beginning. Professor Glaister alluded to the ignorance in regard to malaria twenty years ago, and in student-days they had to answer questions with absolute nonsense in order to pass examinations. They used to have to say that the high fever in malaria was due to something combining oxygen to the red corpuscles of the blood, and now we knew that it was simply due to poisons excreted by millions of parasites. Well, the issues before the scientists to-day were so tremendous, so terrific for humanity, that they must be very careful and cautious in prognosticating or devising practical outcomes of their researches. It was one thing for a man of science to be debating these questions, with constant self-doubtings and with constant criticism from others; it was one thing to work in the laboratory and establish some great truth, and it was quite another thing to rush precipitately into emotional conditions as to practical possibilities before absolute verities had been established. They must be very cautious in regard to practical work before scientific knowledge was complete: and although his belief in what he had put before that Section that day was very strong indeed (in fact, he regarded the matter as plainly as the objects he had before him at that moment) yet the relations of these things had not been completely established. And until they had a remedy for smallpox, a remedy, whether preventive or curative, that was as sure as vaccination, and as safe as vaccination, they must not attempt to alter well-established practice. Mr. Councillor Biggs had mentioned Professor Crookshanks' work. But Professor Crookshanks, like other bacteriologists, had so far as he was aware done no personal work with the "protozoa" of vaccinia, so he did not think they could really be guided by Professor Crookshanks in this matter. So far, too, as he had examined Professor Crookshanks'

work, by casual reading his books on vaccination and other kindred subjects. he certainly did not give sufficient consideration to the work of writers like Hime and many others, who had made very careful experiments, which have shown that vaccinia, as a great German expressed it, means the benign modification of smallpox. That was the immortal discovery of Edward Jenner. Reference had also been made to another horrible plague, syphilis, in connection with which he had spent a great deal of time in investigation, as well as of the other diseases. Now he believed that syphilis was also due to a protozoon, but quite a different one from that which, in his opinion, causes smallpox. There was no more relation between these diseases than there is between typhoid fever and leprosy, which were both totally different diseases, caused by quite distinct vegetable organisms. It seemed to him rather cowardly of people not to be vaccinated, because they, while benefiting by the protection afforded by a vaccinated majority, declined themselves to incur the inconvenience and slight risks of vaccination. Medical men must always be looking for something better, and by all means let them look for something that is better than vaccination. But they must make sure that they had got something better before the present practice is given up.

THE PROGRESS AND PREVENTION OF DIPHTHERIA.

By LOUIS COBBETT, M.D.Camb., F.R.C.S.Eng.

THE highest aim of medical science is the abolition of disease, rather than the discovery of remedies.

Without doubt some diseases can be abolished, as is shown by the disappearance of malaria, sweating sickness, typhus and leprosy from this country. These have gone, more perhaps by chance, or owing to the general improvement of the conditions under which people live, than by direct effort for their individual destruction. Yet it cannot be doubted, that if we knew all the factors in their etiology, we should be able, in the case of some of those diseases which remain, to bring about similar results. The first requisite is more knowledge, the second more faith in the knowledge which we already possess.

This paper deals with the progress and prevention of diphtheria, *i.e.*, with the way in which it propagates itself, and with the means which recent discoveries have placed in our hands to oppose that propagation. In the firm belief that diphtheria will some day be stamped out, it aims at directing attention to the means of prevention which are now available, but which up to the present have not been given the attention they deserve.

Many laymen appear to be surprised that so much attention is given to diphtheria, while more terrible scourges of humanity continue to exist. The answer is simple: we know far more about the etiology of this disease than of almost any other, and consequently its prevention is proportionally more practicable, and moreover many of the general problems of disease can be worked out in this particular case. We know with certainty:

1. The bacillus which causes the disease; we can readily find it where present, and with care and skill can distinguish it from all others.

2. That it lurks long in the throats of some convalescents, and can live in an immune person for an indefinite time.

3. That individuals immune to diphtheria are common, probably

about one half the community in Germany and Austria,* and that when they harbour the bacillus they are capable of infecting others.

4. That diphtheria is spread by *personal intercourse.*

Old beliefs die hard; scarcely a case of diphtheria occurs but it is attributed to "drains," by friends and doctor alike. It is easier to persuade a sanitary authority to spend large sums on patching its defective sewers than to incur a much smaller expense in seeking out those who carry about diphtheria bacilli in their throats.

Almost in vain one points out that diphtheria bacilli are not to be found in drains, much less in sewer gas, and that even the air of a diphtheria hospital ward, except in the immediate neighbourhood of a patient, is incapable of planting colonies of diphtheria bacilli on a serum plate.†

The belief is little short of universal that sewer gas is the predisposing cause, than which the mere presence of the bacillus is of less importance, because it is so common. This view is kept alive by what I believe to be the erroneous belief that the ubiquitous bacillus of Hoffmann is a kind of attenuated diphtheria bacillus, and can become dangerous when planted on a throat suitably prepared; and by that other belief, all too common in this country, that the diphtheria bacillus itself can be found in the throats of a large proportion of healthy persons, whether they have been in more or less direct contact with diphtheria or no.

Let me take these two points a little more in detail.

The authority of Roux, whose opinion justly carries great weight, has often been quoted in support of the idea that Hoffmann's bacillus is related to the diphtheria bacillus.‡

But this is not right, for his remarks on the pseudo-diphtheria bacillus were made in comparatively early days, when the importance of acid-production had not been generally recognised, and before Hoffmann's bacillus had been clearly distinguished from the so-called non-virulent diphtheria bacillus.§

It would take too long to discuss fully the supposed relationship of

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* Wassermann, *Deutsche Med. Woch.*, 1894; Orlowski, *Deusche Med. Woch*, 1895; Fischl and Wunscheim, *Prager Med. Woch*, 1895.

† Author's experiments at Colchester.

‡ Roux and Yersin, Ann. de l'Institut Pasteur, 1890.

§ Indeed, in speaking of the relationship of what he called the pseudo-diphtheria bacillus to the true diphtheria bacillus, Roux distinctly said that the former produced acid. He, therefore, at that moment was not speaking of Hoffmann's bacillus, which forms no acid, but of what is generally now called the non-virulent diphtheria bacillus. It is only when he goes on to speak of the great frequency of the "pseudo-diphtheria bacillus," both in Paris and in a country village, that one believes that he must have been then referring to Hoffmann's bacillus, for the acid-forming non-virulent diphtheria bacillus is relatively uncommon. It is highly probable that he did not test the acid production of

Hoffmann's to the diphtheria bacillus, and it is to be hoped that it is now no longer necessary.*

It will be sufficient to state that Hoffmann's bacillus is to be found in the throats of considerably more than half of the children of the public elementary schools; that this bacillus never has any virulence for the guinea-pig, even when isolated from persons convalescing from diphtheria; that the diphtheria bacillus on the other hand is not liable to become attenuated in the course of its gradual disappearance from the throats of such people† (neither Graham-Smith nor myself have been able to find attenuated or partly attenuated diphtheria bacilli under such circumstances); that the claims to have converted one bacillus into the other will not stand close examination.

At the present time it may be said with confidence, that there is no fact known which supports the idea that the two bacilli are related, and that, on the other hand, everything points to Hoffmann's bacillus having nothing to do with diphtheria; to its being, in fact, a harmless and extremely

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all these bacilli, the importance of the test not being then sufficiently recognised, and that he confused Hoffmann's bacillus, which forms no acid out of glucose, and is a common inhabitant of the throat, with the much rarer acid-forming non-virulent bacillus which cannot be distinguished by its appearance from the true diphtheria bacillus, and included them both in the term pseudo-diphtheria bacillus.

* The necessity of insisting on the harmlessness of Hoffmann's bacillus has, however, not yet entirely disappeared. The metropolitan branch of the Society of Medical Officers of Health, after careful consideration of the evidence, has lately affirmed its belief "that cases clinically resembling diphtheria, but in which the Hoffmann and not the Klebs-Löffler bacillus is found, are infectious, and that consequently the usual precautionary measures of notification, isolation, and disinfection should be undertaken. (Quoted by Caiger "The diagnosis and management of doubtful cases of Diphtheria." S. A. Church, 1904.) Caiger also seems still to retain some belief in the pathogenicity of Hoffmann's bacillus, and thinks that "the fact that certain observers have described outbreaks of apparently infective sore throats in which the Hoffmann bacillus alone was present, and that in some of the cases fibrinous exudation *plus* Klebs-Löffler bacilli were also detected, would appear to suggest that in certain circumstances the Hoffmann bacillus may act as a predisposing factor in the development of the true disease." But why, it may be asked, put the blame on Hoffmann's bacillus for these sore throats? Hoffmann's bacillus is so common that on this principle it might be regarded as the cause of all varieties of infective sore throats, including scarlet fever and measles. It is unfortunate for this innocent bacillus that it resembles in appearance the malignant diphtheria bacillus, and being so commonly present is, therefore charged with causing those sore throats which resemble diphtheria, but in which the Klebs-Löffler bacillus is not found.

† I have myself tested 69 varieties of Hoffmann's bacillus, many of them isolated from patients suffering or convalescent from diphtheria, without finding any which were pathogenic for the guinea-pig, even in large doses: and quite recently Graham-Smith has obtained the same results with 23 cultures from similar sources. Neither he nor I have ever found diphtheria bacilli to undergo any attenuation in the throats of convalescents, we have neither of us met with attenuated bacilli, either they killed guinea-pigs in a few days when very small doses were injected, or else a large dose was entirely harmless. From one patient during convalescence I isolated diphtheria bacilli four times in the course of two months, and found that they retained their virulence. From another patient diphtheria bacilli were isolated six times, and from still another four times: and each of these cultures was tested on guinea-pigs, and its virulence found to be maintained to the last.

common inhabitant of the mouth, especially of children of the lower classes.*

Now turning to the next point, whether true diphtheria bacilli are to be found in the mouths of those who have not come into direct or indirect contact with diphtheria, it may be said that the confusion which exists depends upon imperfect observations which have failed to distinguish the diphtheria bacillus from those which resemble it.

At a time when diphtheria was prevalent in Cambridge, and diphtheria bacilli were being found in 10 per cent. of healthy contacts, about 140 children in a school, situated in a remote part of the town, where no diphtheria was known to exist, were examined. In the throats of none of these children could diphtheria bacilli be found, and the reason seems obvious—because they had not come in contact with diphtheria.

Other similar observations led me to believe that *diphtheria bacilli in healthy persons were only to be found among such as had come into contact with cases of diphtheria, and possibly also in those who had come into contact with healthy people who harboured the bacilli.*

Of course, even this limitation might permit of a wide distribution, the bacilli being passed from the sick to the healthy, and from the healthy to the healthy many times, until this contact became so indirect that it could not be traced.

But as the result of experience in Cambridge and Colchester, it may be stated that if one understands by indirect contacts only those who have come into intimate relationship in class, or at play, with persons who have been directly in contact with cases of diphtheria, diphtheria bacilli were not met with in healthy persons other than the contacts thus defined.

Graham-Smith has extended and confirmed my observations, and has also collected and analysed the reports which deal with this point.

On the one hand, he has collected over 3,000 English and American examinations of normal persons, contacts with diphtheria being as far as possible excluded, "in which morphology in culture alone was in most cases relied on."

Among these, organisms resembling diphtheria bacilli were found 108 times [3.2 per cent.]. It is highly probable that many of them were not diphtheria bacilli, because of 35 cultures from the above, which were tested for virulence, 26 [74 per cent.] turned out to be non-virulent.

On the other hand, collecting those examinations made by various observers, in which all suspicious micro-organisms were tested for viru-

* For the facts upon which these statements are based I must refer to papers by Graham-Smith and myself in the *Journal of Hygiene*, vols. I–IV.

lence, and in which enquiries were made as to the possibility of recent infection, Graham-Smith found that among 1,511 persons examined, virulent diphtheria bacilli were only discovered twice [·13 per cent.]. It is, of course, impossible to exclude all indirect contacts from so many persons, and the discovery of these two infected persons only among 1,500, greatly strengthens the conclusion that virulent diphtheria bacilli are not found in the mouth except among contacts.

Among these 1,500 persons non-virulent diphtheria bacilli were found 31 times [2·06 per cent.]. This is rather a significant fact, for it is improbable that the proportion of persons infected with this micro-organism is no higher among diphtheria contacts. The relation of this bacillus to the diphtheria bacillus is not known, but from the fact that he finds it equally common among contacts and non-contacts with diphtheria Graham-Smith inclines to the view that they are not related.

Much depends on the answer which must be given to this question—are diphtheria bacilli to be found in the mouths of healthy persons other than contacts, for if so, then it is of no use examining contacts only, and it is not possible to examine everybody.

But if not, then we can examine the actual and indirect contacts with cases as they occur and as the notifications come in, and we can isolate, or at least apply antiseptics to them, and keep them under observation, and perhaps to some extent control those who breed the bacilli in their throats and yet remain in their usual health.

It is my belief that virulent diphtheria bacilli are confined to patients and contacts, and that the proper way of dealing with the spread of this disease is to seek out these contacts and to disinfect them.

In order to facilitate the practical carrying out of measures based on this principle, I will briefly state some of the conclusions at which I arrived when attempting to apply them during outbreaks of diphtheria at Cambridge and Colchester.

In order to apply these principles in practice, the sanitary authorities should be prepared beforehand with a skilled bacteriologist, and all the necessary appliances and organization for collecting and examining swabs taken from a large number of persons. On the first news of the outbreak, perhaps in one of the schools, several hundred swabs may have to be examined in the course of a day or two, and every hour's delay will multiply their number. Hence the swabs and serum tubes must be kept ready prepared, and the latter carefully sealed with paraffin so that they may not become dry. Moreover, a clerk should be available for drawing up lists of contacts, etc., *viz.*, the brothers and sisters and other inmates of

the houses occupied by notified cases; the schools attended by the contacts; the intimate playmates of the infected children and their immediate associates in class. All such people are to be examined by culture for the diphtheria bacillus.

The value of these examinations is in proportion to their earliness. One must therefore be prepared to make great efforts at the very outset. To form an idea of the work required, it may be stated that at Cambridge, when a small outbreak occurred in the schools, we were at one time examining over 100 swabs a day, and would have liked to have done many more if we could.

During the outbreak in Cambridge the school attendance officer (who was able to afford the time owing to the schools being closed) gave very valuable assistance in drawing up our lists of contacts. Several medical students who were attending classes in the university volunteered to go round and collect swabs.

The great majority of infected contacts were isolated in a home opened for them and put in charge of a trained nurse. Antitoxin was given to all on admission to this home, in case any of the children in whom we found diphtheria bacilli should have been in the incubation stage of the disease; for it was of extreme importance to prevent the occurrence of a case of diphtheria in the home, otherwise parents would not have allowed their healthy children to be sent there. As it was, much valuable time was spent in explaining to parents why it was desirable to isolate their children.

No kind of compulsion was used, and it is gratifying to be able to say that the great majority of parents proved to be very reasonable when the matter was clearly explained to them.

The success of the measures taken during this outbreak was very marked.

The outbreak at Colchester* was in some ways much easier to deal with, for we were able to put into action at once all the labour-saving details of the method of examination and the organization which had gradually grown up during the Cambridge outbreaks.

On the other hand, we had to deal with an outbreak which had already been in action for three months before our work began; thus we had a very large accumulation of contacts with past cases to deal with.

Naturally it took some time to work through so many examinations; nevertheless, when these were cleared off and we were able to deal with all

* "A Report to the Borough of Colchester on an outbreak of diphtheria, 1901."

contacts as they occurred, the decline in the notification rate was very marked.

There are many other points which I am unable to touch upon in the course of this paper. My object will be obtained if I succeed in securing an active discussion of the merits of the method of combating diphtheria by dealing with healthy contacts.

SUMMARY.

In conclusion, I think it would facilitate discussion if I were to put forward in the following sentence the opinions which have slowly grown up in my own mind on the subject.

The principal means of combating diphtheria are, after the isolation of persons actually sick, the detection by bacteriological examination of those who go about apparently in good health, carrying in their throats or noses the diphtheria bacilli: and the isolation or control and treatment of such persons, and of convalescents from the disease, until diphtheria bacilli can no longer be cultivated from them.

No doubt the satisfactory isolation of those healthy persons who carry about the bacillus will often prove impracticable. In such cases they should be warned that they are a source of danger to others, instructed to take certain precautions which need not be detailed here, be induced to use antiseptic mouth washes and gargles, and should be kept under observation.

In the case of children, and young people employed in large business houses, isolation will usually be practicable: experience among the poorer classes of Cambridge and Colchester having shown that parents can usually be persuaded to consent to the removal of their children to a suitable isolation home.

MEDICAL INSPECTION OF SCHOOL CHILDREN.

By JESSIE M. McGREGOR, M.D.

THE question of the universal inspection of State schools and school children, by specially appointed medical officers, is one that is only beginning to be discussed seriously in Britain. It may therefore be of some use to study the doings of other countries in this matter in order that we may profit by their experiences in aiding us to form our opinion. To do so with the utmost profit let us first summarise the points on which information is most required:—

1. Is the plan successful when given a prolonged trial, as regards children, parents, teachers, and the State.

2. What is the method of organisation in the various countries, in regard to amount and method of examination, and in regard to authorities in charge, school, municipal, or public health.

3. What persons are best qualified to become school doctors, and what is a fair remuneration.

To the first question the answer is a unanimous affirmative on all points. The individual child has its physical limitations decided and its school work proportioned to its capacity. It has at its command that most valuable of all forms of medical effort preventive, and is, as the statistics have shown, saved many forms of disease. The parents find that the child prospers, and there is no unnecessary interruption to lessons, no interference with home-life, or the family physician. In schools where medical examination of children by the school doctor is voluntary on the part of the parents, the majority avail themselves of it, the greater number of parents co-operating heartily. The teachers in all cases find that the work not only relieves them of some responsibility and anxiety, but it also aids them by fitting the children with a suitable curriculum, and it gives the teachers an added interest in their work. As a rule they are enthusi-

astic and valuable assistants, warmly appreciating the greater grasp of their work which is given to them by an intelligent comprehension of the physical condition of their pupils, and also of the relations between their physical and mental processes. The State has already materially benefited in many instances by the introduction of a system of regular medical inspection of school children. Great modifications have been made in the mode of instruction of the very young, in the conditions within the schools, in the nature and extent of school work, in the use of physical exercises, in the prevention of infectious diseases, and in other ways. The result of these modifications will, it is hoped, produce a healthier class of citizens, and prevent the physical deterioration of which we hear so much at present. In all respects the State is a gainer, and as will be shown the cost is not high. These are not merely the opinions of the writer, they are statements of fact, made by responsible authorities in the countries in which the system has had a fair trial—America, France, Switzerland, Germany, and Japan, more especially. In no country in which the system has been adopted has it failed to give growing satisfaction on the four points enumerated; and once adopted it has never fallen into disuse.

As to the second point, the amount of examination has a wide range. In Sweden the school doctor controls nothing but the physical training of the pupils. In Britain and Italy the examination in the State schools hardly goes beyond simple inspection of the schools in regard to their hygienic condition, with, in a few towns, examination of the eyes, possibly of the hearing, some control of infectious cases, and examination of defective children. In many parts of Germany, Switzerland, France, Denmark, and Belgium, there is an examination of all children when they enter the State schools, as a rule there are fortnightly or monthly visits to the school to inspect any cases the teachers may consider abnormal, combined with an inspection of each class in a certain rotation. There is re-examination of all the children annually, or at stated intervals, with especial reference to the eyes and teeth. There is instruction in hygiene for pupils and teachers. In the United States the attention of the school doctors is focussed largely on infectious disease. A daily visit is made at which all suspects are examined, and means taken to prevent the spread of infection. The value of this system as regards infectious disease is shown by the following statement. In one week of April, 1897, 364 children in New York were excluded from school on account of some form of infectious disease (including parasites). In Boston during the year 1896 the number of children suffering from illness, found attending school, was 8,964, of these 234 cases

were acute specific fevers and 628 were skin affections. In Chicago during one quarter of 1901, 2,060 children were present at school showing signs of infectious disease.

In many towns and states provision is also made for the teaching of physiology and hygiene to pupils and to teachers. Austria, Norway, and Turkey are rapidly ranging alongside these other countries, Norway especially having now a regular form of State-suggested inspection in most of its towns and villages. Hungary has throughout its extent a similar and very complete system under State control. It is reserved for Japan, the astonishing old-young country of the East, to attain the record in regard to inspection of school children. Japan maintains 8,434 school doctors, nearly every school and college in the country and every training institution for teachers being under medical supervision, and a complete system of physiology, hygiene and first aid is taught to pupils and teachers, with special instruction in school-hygiene and first aid for the latter. Japan modelled its ideas largely on the Swiss system, but has improved and enlarged them with characteristic acumen and vigour. In the Argentine, Chili, Egypt, Servia, Roumania, Columbia there are systems more or less complete. Russia has inspection of all her high-schools, but not of her "Volk" schools. In regard to Spain and Portugal I could obtain no facts, Greece has apparently no medical inspection.

In order to give some idea of the nature of the inspection, I give an abstract of the instructions given in Wiesbaden, a town which has a model system.

Brief Abstract of the Instructions for the Medical Examination of school-children in Wiesbaden.

All new pupils who do not present a doctor's certificate are examined by the school doctor.

Every child has a schedule filled up by the school doctor with particulars of his examination: this accompanies it through the whole curriculum.

Every child is again examined in the 3rd, 5th and 8th year of its course.

Every child when it leaves school finally, carries with it a health certificate showing an abstract of its health during its school-career.

Certain definite measurements as to weight and height, etc., are made at stated intervals. This is largely carried out by the teachers.

The school-doctor must visit the school every 14 days to see any children the teacher may recommend, and to inspect classes.

He is expected at the same time to observe the sanitary conditions of school-rooms as regards furnishing, lighting, ventilation, cleanliness, etc.

He must give short courses on matters of school hygiene to the teaching staff.

It may be remarked that the first examination of the Wiesbaden children showed that 25 per cent. were suffering from some form of illness, including infectious diseases.

When we approach the second part of this point, the authority in charge, whether state, municipal, educational or public health, we find much diversity. In Italy the system is carried out entirely by the public health authorities, either the district medical officer or a specially appointed assistant. It is only in the large towns that the children are carefully examined, in the smaller towns and villages the hygiene of the schools is the main feature attended to. In the United States the work is done, as a rule, conjointly by the school board and board of health in the various states and towns, but there is no central control. In France the municipal authorities appoint the school medical officers and receive their reports. In Norway the municipal authorities are responsible under the Board of Education. In Japan, Russia and Chili the Educational Department has special central medical boards or committees in connection with school hygiene. (In Japan the political governor of the province appoints the school doctors). In Britain each school board pursues its own system and appoints its own doctors, for although the public health authority has powers to take control it has never carried them to the point of systematic examination of school children. In Prussia the work is controlled in some instances by the municipality and is done by the State district doctors, in other cases the school boards appoint special medical officers, responsible to the boards alone. In the other states of the German Empire the conditions vary, Saxe-Meinigen stands apart in having compulsory medical inspection of the children of all classes of schools, public and private, through its school boards. Austria has State-imposed inspection by means of district doctors and also in some cases of special doctors, appointed by the educational authorities in collaboration with the public health authorities. In Switzerland each canton has its own school organisation which controls the school doctors and makes its own regulations. In Hungary the school doctors are State-appointed after a preliminary course of study and a qualifying examination. They act on the local school boards. In Turkey the

school medical officers have a chief or senior in each large town, and send their reports direct to the Minister of Education.

It will be seen from all these instances that there is no one system of control that is yet pre-eminently in favour. This is undoubtedly due to two circumstances. Firstly, the fact that in most countries the experiment was primarily made in isolated towns, and in a tentative manner, each town trying its own methods, and each having already in force some form of sanitary inspection. Secondly, there is undoubtedly in the work of inspection of schools a certain natural division, into the purely sanitary, affecting the children as a mass, and the personal inspection of the individual child. While in no way antagonistic, the work is dissimilar. The sanitation belongs essentially to the public health department, infectious diseases form a transition stage, and the determination of the physical condition of the child belongs to what the Germans call the practische Arzt, the practising physician, rather than to the sanitary authorities. The question that thus arises brings us to the final point on which we desired information: What persons are best qualified to become school doctors, and what is a fair remuneration? Is it best to have a school doctor who is at once sanitary inspector and child inspector, or to have a sanitary expert for the one set of duties and a practical physician for the other, and in either case under what authority is he to be placed, educational, municipal, or public health? In Britain up till now, where special school doctors have been appointed, the educational authorities have had complete control, and the tendency in regard to the State school has been to appoint one inspector in charge of all State schools in each town under the educational board, with assistants for special work. However, we must bear in mind that in Britain there is practically no systematic examination of the children, and the work of the medical officer has been chiefly concerned with the sanitation of the schools. This is also the case in Italy. In countries where systematic examination of school children is carried out, the practising physician has been called upon to do it. It is not necessary in a paper of this character to do more than draw attention to this point and to emphasise the necessity of taking care that if Britain accepts the school doctor, whatever system may be adopted, there shall be uniformity throughout the country, and some central authority in control to make general regulations for all schools and to accept reports. Undoubtedly other countries have lost much by reason of the want of uniformity in the methods in vogue in their towns and provinces, and we should, if wise, draw the lessons from their mistakes and experiences. It seems unwise that two medical officers should have equal authority in the same school, and yet unfortunately the

average physician in general practice is seldom a sanitary expert, while the sanitary expert is, in this country, seldom a practising physician. It would appear, therefore, that there are two courses open. The practising physician, if he is to take complete charge of the hygiene of school and pupils, must have, as in Hungary, a definite preliminary training in school hygiene, qualifying him or her as a school doctor, or the authorities must appoint one or more experts in sanitation, whether the medical officer of health for the district or special officials, to undertake the purely sanitary side of school hygiene and appoint others, purely practical physicians, to assist them in all that concerns the children directly, personal examinations, modification of work, etc. Whatever system may be adopted, there will be a necessity for intelligent co-operation on the part of the teachers, and these must therefore be supplied at some time in their career with a course of instruction in school hygiene. This is such an obvious necessity, apart from the question of medical inspection of school children, that there is no need to urge it further, it must come in time, and in many countries it is already very thoroughly carried out. Whether the work is done under the local public health authority, the local school authority, or under one central authority on school hygiene in the Educational Department, there is no doubt that the physician must be paid for his or her labour. The rate of payment varies in other countries as much as other features in the system, from nothing at all, as in the case of Italy, to a salary of £600 a year given by Manchester school authorities to their medical officer. I append a table showing as far as could be ascertained the facts which may be accepted as fairly correct.

It is of some interest to compare the numbers of school doctors in the various countries. Japan heads the list with 8,424, Germany follows with 676, in 234 towns (Prussia owning 153 of these); America has at least 500 special school doctors; France must have a large number, since in Paris alone there are 128; Hungary has 80 qualified school doctors; Austria has 56; Norway has 59 advanced schools and many urban schools supplied with doctors; and in Belgium, Brussels alone has 52. Britain with its score or so of school doctors for its dense population presents a curious contrast. There, however, many private and better-class schools have organised inspection and examination of their pupils apart from any school board or State regulations and employ doctors to carry out the work in many cases.

In conclusion, it is evident that systematic physical examination of school children in State schools by medical experts is now accepted in

Table showing Conditions in the various Countries.

Country.	Town.	Number of Doctors.	Number of Children under each.	Pay.	
Argentine	Buenos Ayres	3	.....	.....	
Austria	Vienna	Each district has one	.....	.....	
„	Aussig	4 (district doctors)	.....	No extra pay	
„	Brünn	10, and oculist	.....	„	
„	Carlsbad	Each district. Dist. Dr.	.....	„	
„	Graz	„	.....	„	
„	Lann	1	.....	400 kr.	
„	Prague	5	.....	1,000 kr.	
„	Troppau	5	.....	.....	
Belgium	Antwerp	4	4,500	1,800 frcs.	Most other towns, Louvain, Liege, etc., etc.
„	Brussels	52	.....	.....	
Chile	.....	.....	.....	.....	
Columbia	.....	12 (4 coloured)	.....	$6,000 for whole No.	
Denmark	Copenhagen	4	2,500	400 kr.	Several smaller towns.
Egypt	Cairo	3 (1 chief, 2 assistants)	1,560-1,700	Chief, 12,000 frcs.; Assistants, 3,500 each.	
France	Paris	128	1,200-1,800	800-1,500 frcs.	
Germany	Berlin	36	1,800-2,000	1,000 mks. for 2 schools	All large towns, and recently village schools, are similarly organized.
„	Altendorf	.....	.....	600 mks.	
„	Bonn	3	.....	600 mks.	
„	Breslau	25	2,000	500 mks.	
„	Charlottenberg	14	.....	400-1,000 mks.	
„	Chemnitz	9	.....	500 mks.	
„	Danzig	.....	.....	225 mks. for 15 classes Every additional 5 classes, 75 mks.	
„	Darmstadt	4	1,400-1,600	750-1,500 mks.	
„	Dresden	16	4,000-5,000	500-600 mks.	
„	Elmshom	.....	.....	50 pf. for each child ex.	
„	Erfurt	4	.....	1,600 mks.	
„	Frankfort-on-Maine	11	1,700	1,000 mks.	
„	Giessen	1	.....	1,600 mks.	
„	Königsberg	10	.....	.....	
„	Leipsic	15	3,000-4,000	400-500 mks.	
„	Nurnberg	6	3,000	600 mks.	
„	Offenbach	7, and one oculist	.....	1,500 mks. Oculist, 250 mks.	
„	Plauen	3	.....	500 mks.	
„	Posen	8 (of whom 2 are specialists)	.....	300 mks.	

,, ...	Saxe-Meinigen	.....	1,200-1,500		
,, ...	Schonberg	6	.....	1,000 mks.	
,, ...	Wiesbaden	6	1,200	600 mks.	
Great Britain ...	London	1 chief, 6 oculists	All schools		
,, ...	Bradford	1	All schools	£300	Also Newcastle, Brighton, and Halifax.
,, ...	Burnley	1	All schools	.....	
,, ...	Croydon	1	.....	.....	Done by City Medical Officer of Health.
,, ...	Manchester	1	All schools	£600 for whole time	
,, ...	Salford	Med. Officer of Health, 2 assistants	All schools	£100 in addition to salary. Assistants, £200 each	
,, ...	Edinburgh	2 (1 a woman)	.....	.....	Merely examine prospective pupil-teachers. Fee: 2/6 for each candidate.
,, ...	Glasgow	The Medical Officer of Health does some voluntary examining			
Hungary	Buda-Pesth	.....	.....	400 kr.	Many other towns.
Italy	Rome	Have special Medical Inspectors	.....	No additional pay, except when special appointment	All schools and scholars examined by district doctors, acting under Public Health Authorities.
,, ...	Milan		.....		
,, ...	Bologna		.....		
Japan	Tokio and all other towns and larger villages	8,424 doctors in all	8,291 schools Average 1,050 children.	In all, 300,000 mks.	
Norway	Christiania, most other towns and villages	1 in each district	.....	250-400 kr.	Chiefly in advance and urban schools.
Roumania	.....	1 chief State physician, with assistants	.....	.....	All schools examined.
Russia	Moscow	6 (2 are women)	.....	.....	All "High Schools" have compulsory examination of scholars and schools, not poorer schools.
,, ...	Kiew	3 (1 is a woman)	.....	.....	
Servia	Belgrade	In all schools			
Switzerland	Zürich.....	... ..	.....	Gratuitous	
,, ...	Basil	1 Professor of Hygiene and assistant	.....	Prof. gives services. Assistant, 1,300 frs.	
,, ...	Geneva	12			
,, ...	Iverdon	.....	.....	100 frs.	
,, ...	Lausanne	.....	.....	1,000 frs.	
,, ...	Lucerne	.....	.....	1,000 frs.	
,, ...	Chaux-de-Fonds ...	.....	.....	500 frs.	
,, ...	Montreux	.....	.....	200 frs.	
Turkey	Constantinople	4, and chief doctor	.....	.....	Other towns.
United States of America...	New York	300	1,000	$200 / $2,500 for chief	Many other towns have school doctors. Milwaukee, Louisville, St. Louis, Cambridge, Buffalo, Salt Lake City, Providence (1 a woman). Washington (1 a woman).
,, ...	Boston	55	1,400	$1,000	
,, ...	Brooklyn	6	.....	.....	
,, ...	Chicago	9	.....	.....	
,, ...	Philadelphia	15	.....	.....	
,, ...	Newton	1 in each ward	.....	.....	

most countries as a corollary of State education, and the two must go hand-in-hand if the schools are to turn out their pupils with the healthy mind in the healthy body essential to good citizenship. Britain through her tardiness can reap where others have sown, and found her work on other's experiences, thus saving herself much of the experimental stage.

The above represents as nearly as could be arrived at the present condition of affairs, and is given more as a general indication than as matter for reference.

Dr. Leslie Mackenzie (Edinburgh) said that, as all those interested in the subject knew, the recent report on the subject of physical training was based on a limited number, 1,200 children, 600 in Aberdeen and 600 in Edinburgh. He did not wish to push too far the conclusions to be drawn from the examination of so small a number, but the facts were held to be sufficient to justify Parliament in inserting in the new Education Bill for Scotland powers for the school boards to deal with the question. The Bill now before Parliament contained clauses enabling school boards to spend funds for the medical inspection and examination of the children, and for their supervision. But how far should that medical supervision and examination go? Some say how much, some say how little. He thought it might be accepted for practical purposes that at least eyes, ears, throat, and teeth should be the subject of examination. Matters of measurement, weight, growth, and height were so simple and obvious, and could be easily recorded, that these matters might also be accepted. The real purpose of the Commission on Physical Training was to enquire how far physical education can be pushed in the schools, and in what form such education is best fitted for school children. As they knew, the danger of ordinary physical training was the application of a physical system too rapidly and too strongly in a single direction, with possible results of damage. Consequently they hoped that the physical education of the children in the schools of Scotland would be more scientific and more extensive, a condition precedent being that the child should be ascertained to be fit to undergo such strain. In Dr. Kerr's recently published report were set forth the details of an elaborate system for the physical examination of children, which, although for the moment in abeyance, would it was hoped be realised in time. Dr. Kerr hoped to obtain the relatively exhaustive physical examination of something like 50,000 school children, and also of the examination of the eyes of the children in the London schools. And the fact that Dr. Kerr had suggested it on the basis of his previous experience was proof that the examination was thoroughly practical and a possible quantity. The question of

who should control such examination, or should have the direction of it, was a matter it seemed to him that could not be settled on any general principle. They would have to work according to local powers and customs. What would be suitable for London, for instance, might not be suitable for Scotland.

Dr. W. Butler (Willesden) said the question as to who should undertake this work was whether it should be undertaken by a specially appointed medical man or by the medical officer of health. He was strongly of opinion the latter, and added that the medical officer of health should be provided with whatever assistants were necessary acting under his general direction. He thought it was of the greatest importance that they should not be divided so as to have competing authorities on health administration. This was eminently a question of health, and there was perhaps no domain in which the medical officer had more help than in the information which came from inquiries into school hygiene. Then again, when they considered the details, what was to be done in regard to the medical inspection of schools and scholars. It had been arranged that in every school each year the teacher should examine the eye-sight of each child. That might sound very dreadful to a medical man, but it simply meant that the child should read test-type, with each eye separately, and the mere fact recorded as to what is the state of the child's vision. Wherever the vision fell short, then a note, signed by the medical officer of health, should be sent to the parent of the child, advising that the child should be taken to an ophthalmic surgeon and its vision tested, as its sight was defective. With regard to the question of non-notifiable disease, the medical officer of health has more information with regard to non-notifiable disease than of notifiable disease from the teachers and also by the work of the lady health visitor who inquires into these cases. The information the Public Health Department got in this way is enormous. As to weighing and measuring, he had been able to arrange for this by way of experiment in two schools in his district. Each scholar was to be weighed four times in each year, the results recorded on a card and given to him from the schools, and upon the results he was able to advise what further steps should be taken in the way of obtaining further information.

Dr. R. H. Crowley (Bradford) thought that by far the most important part of the question, at any rate at this juncture, was that of organisation. It was certainly not much use discussing details in England when at present there was so little medical inspection of the schools. But the first step should be the appointing of a medical officer by the education authority to give all or part of his time, and then there could be the appointment for special work as the occasion arose, say an oculist and so on. A great deal of this work was of a personal character, and involved the study of educational methods and details. This

opened the question whether the training of the medical officer of health and the kind of daily work he had to do rendered him suitable to fill the post of school doctor, or whether under those circumstances the school work with him might not have to take a secondary place. In many places the work would be done by the medical officer of health because the community would not pay for anyone else to do it. As a result of his experience in this work, and as medical officer of the Education Department of Bradford, he thought that, at any rate in large cities, the duties were so great and the work was of such a character that a man should be specially appointed for the office.

Mr. A. Weekes (East Sussex C.C.) expressed the opinion that the work was quite enough for one man to do to carry out the inspection of the scholars in a large number of schools. It therefore seemed to him that as the education committee of the county councils had to look after this work, it would be part of the duty of the county councils, if of anybody, to appoint a medical officer entirely for this work.

Dr. J. F. J. Sykes, D.Sc. (St. Pancras) said, from the speeches they had heard that afternoon, they must now come to the conclusion that it was impossible to lay down any general rule on the subject. In some districts, where the medical officer of health only had a small area to cover, and where only a small portion of his time was taken up with public health duties, it might be a useful proceeding to take the whole of the time of such officer and to fill up his time with school work. In some places that might be an excellent arrangement. But in very large districts it was impossible for the medical officer of health to undertake these duties. Analysed, those duties came to this; first of all, there was the school building, and that building would be one of many in the locality, so that it would clearly come under the management of the Public Health Department and the medical officer of health; secondly, there were the children in the building, those children were of course a part of the community. That was an important thing to remember, and in regard to the health of the children outside the school, it was undoubtedly a duty on the part of the Public Health Department and its officers to look after the children when they were outside the school. Then when there occurred any infectious disease, there was the Public Health Authority again stepping into the school. But there was now another question which had arisen since the days when the medical officer of health first commenced to look after the schools in the manner in which it has been done up to the present, and that was the degeneration of the infant population. As to how that degeneration had arisen, there had been various official reports, and everybody had come to the conclusion, not only in England, but also in Scotland, Ireland, and every country in Europe, in fact, that a periodical examination of school children was necessary; but that was quite a different thing from

the question of the buildings and of the children from the point of view previously treated. The periodical examination of the children referred to the examination of their eyes, ears, throats, and senses generally, and of their physical condition, height, weight, and so on, probably half yearly or yearly, according to the size of the district. This would be a regular periodical examination that could not possibly be undertaken except in very small districts by the medical officer of health, although even in large districts it might be undertaken by an assistant medical officer of health, which of course was where the crux would come in. If there was, so appointed, a professional man thoroughly trained in school hygiene, there would come a point at which that man would consider himself really a leading officer in the subject, and he would object to be placed under the medical officer of health of the district in which the schools were situated. The teacher had thrust upon him or her the duty of not only distinguishing between sick and sound children, but also between all the little differences that may occur in sickness and disease. That was an untenable position, and it appeared to him that there must be in connection with the schools, someone, whether a medical officer of health, or a specially appointed medical officer of the school, or a local practitioner near the school, or some other medical person to whom a child could be sent, or who could be appealed to at a moment's notice to decide whether the child was suffering from any infectious disease that barred it from school attendance. That was really what was wanted, and he thought that any attempt that might be made to educate the teachers so as to justify the throwing upon them that responsibility would be a failure and this would be a very serious matter.

Mr. J. Cameron (Montrose School Board) sympathised with the views of the last speaker, and at the same time sympathised with the view that the medical officer of health should be entrusted with the duty where practicable. His reason for this was that there were strong objections to the further multiplication of officers. Both school boards and town councils were opposed to such multiplication. He thought that in most cases the teachers and the medical officers of health could mostly meet all the requirements of the case. He thought, too, that there was no real difficulty about notification or in consulting the medical officer of health in difficult cases.

Dr. R. A. Paget Evans (Warwickshire C.C.) thought that whether or not they were agreed as to the medical officer of health being appointed to discharge these particular duties, they would all agree that it was necessary to have some medical control of the school children. But in England not a single county council had taken up the matter, which was of the first importance. Now, the duties of a medical officer to the school were several. First, and by no means least, he should be able to grant certificates to children who are unable to attend school. That was done at the present time, and

certificates could be given by any medical man, and the school authority was obliged to accept them. But if the county council or the education authority were to appoint a medical officer from whom these certificates could be obtained free of cost, they would get a very much larger attendance of children in all the schools. That question of attendance was very important from an educational point of view. The point before the section was as to whether it was necessary for educational authorities to appoint their own medical officer. Such a medical officer would have nothing to do with buildings, so far as their sanitary condition was concerned. That was a matter for the local sanitary authority. The point, which seemed to have been missed, was whether the Section should recommend that a medical officer of schools should be appointed. The matter had nothing to do with the medical officer of health. Such public officer might be utilised at times, but they had no claim upon the medical officer of health; he was the officer of the sanitary authority.

Councillor Smith (Birmingham), speaking from the teachers' point of view, said he was very glad to hear that it was not proposed to impose this new work on the teachers. Indeed, he pleaded that there should be no further duties placed on the teaching staffs. As a teacher he strongly objected to having the responsibility placed upon him of judging the condition of a child's health. One result would be to draw upon them afresh the enmity of the parents, with whom already they had a great deal to contend. There was a great deal said even now about infringing the liberty of the subject. If he had a vote in the matter he would strongly support the views of Dr. Evans, that there should be a gentleman appointed to inspect the children, irrespective of the school buildings, and they should not ask the teacher to take upon himself or herself duties for which they were obviously not trained.

The Chairman (Professor Glaister) said that with regard to this proposed medical inspection of school children, about which so much had usefully been heard that day, they all knew that when a saint was about to be canonised, the preliminary step taken by the Pope was to appoint an advocatus diaboli, or devil's advocate, and so in some matters it was a good principle to hurry slowly. The writer of the paper started with the title "Medical Inspection of School Children"; they had all proceeded in the discussion on the assumption that it would be of great value, and that it was of the utmost necessity that all school children should be inspected. Now, had they established that thesis? Had they proved conclusively that there were reasons why school children should be examined more than other children of school age? There had been a reason hinted why school children should be examined, viz., that school children were got together, and that it was then that something might be done to prevent that physical degeneration about which so much had been heard during the last few years. He would not give any reasons whether or not school children should be

examined and inspected, but all he would ask was had they justified their thesis that school children ought to be inspected? And if school children should be inspected, why not infants in arms? and if infants in arms, why not all young people who are liable to physical degeneration at various stages? Then the next question was, if that work was to be done, who was to pay for it? The practical man on the school boards or on the town councils would say this means money, an increase of the rates. Such a man would say to himself, "I have got to advocate a new rate, I shall lose my seat." These were practical questions that must be heard, and such representatives would turn round and say to those who were advocating the step, "You are exceedingly good at suggesting new offices which you are going to fill yourselves." Therefore they should be perfectly frank with one another. Who was to do the work? A number of people had been suggested by the various speakers, each of whom had his own reason for favouring one individual against another. That was a matter he would not discuss; those waters were too troubled for his liking. But what he wanted to ask was, assuming they were all agreed that the work must be done and that somebody must do it, how was it to be done? Some wanted the children to be examined this way, and others wanted another way; some wanted the eyes examined, others the teeth and the throat, and so on. Some said the children ought to be fed. If fed, why not also clothed? Where was the movement to end? By and bye it would almost seem that it would only be necessary for the parents to start the machinery for supplying the child and the State would do the rest. Perhaps they might be tending a little too much in that direction, and his point was, where did the parents' responsibility end and where did it begin? When they had got over the question of who should be the medical inspectors of schools, there would be the question as to whether all schools should be treated alike. Educational institutions of the elementary class were supposed to be equal, and he did not think that county councils or school boards would be quite unanimous on the subject of medical inspection of schools, and he could not blame them. If the work was done it would be perfunctorily done until the necessity for the work was thoroughly established. There must first be established the principle, and reasons given for doing the work. To his mind there were only two reasons for the medical inspection of schools. If a case were made out that the children are being made mentally or physically worse by school education, then it was time the State stepped in to guide that physical and mental education in order to protect the child in the school, as the child in the factory was protected; the child was not to be attacked when it was unable to help itself. The other point was this: as in the Poor Law where the State stepped forward to assist people who could not help themselves, so the State steps forward and compulsorily educates the children. Now, if the State compulsorily educates the children, it was the duty of the State to see that the children were in the best position to be educated, and that the education offered them was of the best. That was the plain, common-sense reasoning of the man in the street. He

had been saying that on the principle of the devil's advocate, and up to a certain point he was quite in sympathy with the proposal that school children should be inspected. But he was not quite clear, despite all that had been written and all that had been said that afternoon, how it was to be done. They did not appear to be at that stage yet when they knew their own minds, and that would take some time. They had not yet got to the point whether these children could be said to be fit for geography, and those children fit for something else, or some other kind of instruction. Therefore, as reasonable people, their view must be to suggest, in regard to this demand for medical inspection, to school boards and county councils and other educational authorities that, as the State compels all children to be schooled, the reason for having this medical inspection is to ensure the children being in such a physical and mental condition as to be fit to receive that education. Secondly, that the education made for them was the best fitted for the children to receive. The other point, as to how far the work can be done by existing machinery, was a point that could be safely left to the future. On the whole he thought they could congratulate themselves upon the fact that they had now got a little "forrarder" on this vexed question.

SOME ADMINISTRATIVE MEASURES TAKEN AGAINST MALARIA AND CONSUMPTION IN THE TROPICS.

By SIR RICHARD C. TEMPLE, Bart., C.I.E.,

Late Chief Commissioner, Andaman and Nicobar Islands.

ABSTRACT.

THE Andaman Islands are situated in the Bay of Bengal and are thoroughly tropical. They are hilly, naturally covered with jungle, and surrounded with mangrove swamp and coral reef shores. The Penal Settlement of Port Blair is situated in and about a large harbour in the South Andaman Island. The inhabitants of the Penal Settlement occupy the harbour, islands in it, and about 300 square miles round it, partly cleared and partly forest. The rainfall varies from 130 to 200 inches per annum in parts, and the crops are chiefly "rain crops." The islands are a home of the mosquito, and malaria is much the most common disease.

The population consists of convicts and those over and connected with them. There are from 12,000 to 13,000 convicts and 4,000 others, of whom 1,400 are children. They are scattered over the whole settlement in convict stations and in villages. The bulk of them are under a strict discipline, and all are under Government control. Of late years administrative measures have been taken to control the spread of malaria and also of consumption (phthisis and tuberculosis) among this population.

Convict health statistics must be read with caution, owing to Government interference with the natural course of diseases, but nevertheless Port Blair statistics show that monthly rainfall does affect the sick rates, these being much the highest during the rains; and that acclimatisation greatly affects them also, the new arrivals chiefly filling the sick-rate tables. Malaria (47 per cent.), with consequent dysentery (7 per cent.), accounts for 54 per cent. of the sickness in the place. Consumption accounts for 6 per cent., and is steadily increasing. It was with regard to checking malaria, dysentery, and consumption that special experimental administrative measures were taken in 1902 onwards.

In 1867 an important medical report was made, showing the great preponderance of fevers as a general cause of sickness, and, incidentally, that keeping a small island clean and cleared of excessive vegetation resulted in the fact that the fever-rate was there lower than that of the other diseases. This was attributed to the absence of miasma, though it would now be attributed to giving small opportunity for mosquitoes to breed.

The steps taken in 1902 were, first, to ascertain the simplest and cheapest methods locally applicable to prevent mosquitoes from breeding, and then to create a strong convict mosquito brigade at all convict stations, to define its work in detail, to instruct the members, and to provide them with suitable tools. Free residents were shown how they could help. These steps had a general as well as a special sanitary value. A village mosquito brigade of ticket-of-leave convicts was also organised to meet special requirements, every member was instructed in his duties, which were defined in detail, and he was encouraged and supervised in his work. The result ensured general cleanliness.

The ceaseless arrival of fresh convicts from India prevents the effects of such measures from being quickly apparent, and the author left before they could be seen, but in the smaller islands mosquitoes were sensibly reduced in numbers in a very short time.

As from ignorance the convicts proved to be very slow to perceive the advantages of sanitation, and offered passive resistance to all improvements, advantage was taken of the ambulance and first aid training established amongst them to educate them in the nature of malaria and consumption, in simple means for combatting them and in elementary sanitation, with much success, though with much labour on the part of the medical authorities.

Among the experiments tried against malaria was the netting in of some barracks in the female jail, which created a difficulty, as the nets excluded both air and mosquitoes, and so tended to promote the spread of consumption.

The question was very carefully discussed at Port Blair, and finally submitted to the Government of India for decision shortly before the author's retirement, and the decision, if any, is not known to him; but the advice he gave as the result of the local discussion was briefly this. That consumption could be best met by additional sleeping floor space in the barracks, more changes of clothing in view of the unavoidable exposure to damp and rain, additional establishment for medical inspection and weighment of convicts to ensure early detection of the disease. To check malaria he advised mosquito brigades as of great general sanitary value,

and the use of quinine as a prophylactic, in addition to the remedies that applied equally in the case of consumption. To check the dysentery, as being "institution dysentery," he advised segregation on detection. What action has been or will be taken on this advice he does not know. He also advised that in the conditions of Port Blair that mosquito netting be abandoned, as the brigades were a sufficient remedy.

The points of interest for the Congress in these experiments appear to be:—

(1) Malaria is an overwhelming cause of incapacity for work and of death in the tropics.

(2) A place like the Port Blair Penal Settlement affords exceptional opportunities for experimental administrative measures for combatting it.

(3) The presence of malaria and consumption in the same locality as dominating dangerous diseases (the usual dangerous Oriental epidemics, like cholera, typhoid, plague, small-pox, beri-beri, are absent from the Penal Settlement) presents a difficulty in dealing effectively with malaria on existing theories and practice which requires full consideration.

Sir R. Douglas Powell (London) observed that there was not much room for comment on Sir Richard Temple's paper. The author was, however, to be congratulated upon his success under difficult circumstances, for the people among whom he had introduced his system of working were exceedingly hard to manage. The difficulty was perhaps overcome by the wide control and disciplinary powers which the author had possessed as Governor of the island, but a greater difficulty remained in the fact that he had to combat two diseases that called for different forms of treatment: malarial fever and tuberculosis. The modern view regarding the communication of malarial fevers and how best to combat them demanded that mosquitoes should be prevented from gaining access to the victims, and this was best effected by means of mosquito nets and similar devices. But, as Sir Richard had told them, this was accompanied by the disadvantage of an insufficient supply of fresh air, for, as they well knew, even the thinnest gauze placed over a window was apt to render the air of a room stagnant. The consequence was that as malarial fever diminished there was a tendency for tubercular infection to increase. He was therefore of opinion that it was right to revert to more general measures by improving the surroundings and by removing all filth, and in that way to destroy the breeding grounds, not merely of the mosquitoes, but also of the tubercle bacillus, or at least of those places where the bacillus might be supposed to enjoy itself when not in the human organism. Unfortunately, Sir Richard Temple had not been able to give his results in a completed form, as he had left before the experiments were concluded. As

would have been observed, there were great fluctuations in the death-rates of the different periods referred to in the paper, and it would be interesting to know whether there was any relationship between those fluctuations and the rainy seasons, or whether it was possible to explain them in any other way. What was required was periodic publication by the India Office of the results of such experiments, and with the view of obtaining that publication he proposed: "That in view of the fact that the Penal Settlement at Port Blair affords exceptional opportunities for effective experimental measures for checking the spread of malaria and consumption, it is recommended that the Council of The Sanitary Institute represent to the Government of India the value of communicating from time to time the results of the experiments inaugurated there in 1902."

Mr. A. Weekes (East Sussex C.C.) said (as to the causes of the great fluctuations in the death-rates referred to by Sir Douglas Powell) he might offer a probable explanation. During the years 1871, 1872, 1873, and 1874, when the death-rate was very low, there occurred the Bengal famine, when the monsoon failed for two seasons, and the Andaman Islands, being in the line of the monsoons, also suffered; so that when there was a deficient rainfall, and many pools and rice fields were dry, there were fewer breeding places for the mosquitoes, and then at all events they were not so prevalent as in normal years. Curiously enough, the only other low death-rate, viz., that for the period ending 1887, corresponded with the time antecedent to the great Madras famine. When he was in India the connection of malaria with the mosquito was unknown, but he used always to associate malaria with rainfall, and particularly with the stagnant rice fields, which are the great breeding grounds of this particular pest.

Sir Richard Temple, in thanking the Conference and Sir Douglas Powell, said that he placed more importance upon the results of the experiments which he had carried out from the fact that, as Administrator of the Islands, he had possessed complete disciplinary powers over practically the entire population. As to the question of the supposed connection between the wide fluctuations in the death-rate and the rainfall at different periods, he had been collecting statistics bearing on these points for some time, but was not satisfied that any definite conclusion could be arrived at. It was quite true that during the period 1871 to 1874 there had been a small rainfall, but in the period ending 1882 there had been a low fever rate and a high rainfall. On the whole, he did not consider that the rainfall had any great influence upon the fever death-rate.

The President (Prof. Glaister) also took part in the discussion.

PREVENTION OF INFANTILE MORTALITY BY HELP EXTENDED TO THE EXPECTANT MOTHER.

By Mrs. C. HAMER-JACKSON.
(Associate.)

SO much is continually said about infantile mortality caused by bad food, bad clothing, and bad hygienic surroundings, mostly the result of ignorance, that a few words would not be out of place in favour of the poor expectant mother, willing to bring a healthy child into the world, and to bring it up according to the laws of hygiene, but utterly unable to do so by reason of poverty and often of abject misery. It is to be wondered at that charity seems willing only to offer a helping hand when the damage is already done, and an unhealthy child has come to swell the mass of invalid infants and the already crowded wards of children's hospitals.

How can it be possible for a woman to give birth to a healthy child, when misery condemns her to hard labour at a factory, laundry, or similar work, badly paid, incapable of feeding herself according to her state of health, and living the greater part of her life in the most impure atmosphere till the very day her child is born.

How many women in poor districts are cleaning steps for a few pence when actually in labour? The question has been studied for a long time on the Continent by doctors and legislators, and it has been proved by statistics that rest for the expectant mother, in the last month at least, has a considerable influence on the general health of the new-born babe.

It has also been proved, that a child is born on an average twenty days later, when the mother has been able to rest, than when she has been obliged to work hard on scanty food. This statement, which may seem exaggerated, has been established by statistics, and is supported by eminent men in the medical world. The importance of these observations is enhanced by the fact that it is in the last month, that the child who is coming into the world grows the most rapidly in size, the babe gaining in weight from 30 to 36 ozs. in the four weeks preceding birth.

Therefore the necessity of helping the expectant mother, for a few weeks at least, towards the end of the gestatory period.

In the lying-in hospitals (which in London offer 180 beds for a population of millions) only respectable married women are admitted, and then only when the labour of child-birth has already begun; with the result that two years ago (within six weeks) three births actually took place in tramcars leading to one of the largest lying-in hospitals in London, the poor women in each case not having had sufficient time to arrive at the hospital. It is no uncommon occurrence for children to be born on the steps of the lying-in hospital, with what results to the health of these unfortunate infants, is best left to the imagination of those interested in the subject.

As for the girl who has got herself into trouble (with the exception of the Queen Charlotte Hospital in London, where she can only be admitted when in labour) she has no refuge but the workhouse infirmary. It was at the Congress in Glasgow, in 1874, that the Rev. Elder Cumming in a remarkable speech strongly advised the creation of crêches all over the kingdom which have proved such a success in helping to save infants' lives. Perhaps it is not then out of place to suggest here the foundation of refuges for the mothers of the lower classes on similar lines to those existing in France and other countries on the Continent.

One of the brighest gems of French philanthropy is without doubt the numerous refuges open to all poor expectant mothers, without any reference to their moral standing. The fact that they are expectant mothers is sufficient to enable them to find proper food and housing before and after the birth of their child. At any period before the expected birth, the woman, if she can prove to be without employment, and is willing to work, can claim admittance. For that she will come provided with a doctor's certificate as to the state of her health. She will then have to submit to certain rules of hygiene, take a bath, and leave off her garments, when she will be clothed entirely in the costume of the house which she has entered. The women are then submitted to a medical examination to find out if they can be allowed to work and to what work they can be put. According to their strength and aptitude they are then put to needle or laundry work.

They all receive a small salary, apart from their lodging, food, and clothes, of from 2d. to 6d. a day, according to their work.

The needlework is entirely for clothes for different charitable purposes, and the laundrywork is also for the washing of linen belonging to philanthropic institutions.

The women rise at 6 o'clock in the morning in the summer, and 6.30 in the winter. Breakfast at 7.45, work at 8. Hot lunch at 12, rest one

hour, work again 1.30. Light lunch and rest at 4, when work is again resumed at 4.30 until 6 p.m. Recreation till dinner, which takes place at 7 o'clock, and bed time is 8 o'clock in winter and 9 o'clock in summer.

They stay in these hospitable houses, away from all worries and troubles, until about 6 weeks from the date of the probable birth, when they are no more expected to work. They are then transferred to another branch, where they are only required to do the housework necessary to keep up the establishment, such as sweeping the rooms, washing up crockery, etc. Their spare time is now utilized either in preparing their baby's layette with the materials given to them, or working for themselves. If they feel so disposed they can work for the institution, for which they receive a small compensation.

The most complete secrecy is kept as to the presence of these women in the place, and no questions about them are ever answered. Even in cases of warrants or enquiries from the police, a special order from a magistrate must be produced before the information required can be supplied. The women can keep a perfect *incognito*, and give whatever name they like, no certificate of birth or marriage being required.

Only the women themselves have the right to make their presence known; they are not debarred from receiving visits from their friends, but it rests entirely with themselves to take advantage of this.

Should any of them desire to avail themselves of the privilege, a letter must be written which receives a special stamp of permission from the directors, and it is only on presentation of this permit that access is allowed to visitors, or questions answered.

When the infant is born, and the mother well enough to leave the institution, she receives a set of clothes for the baby, and, especially if she promises to nurse her child, a sum of money. In such cases the board of the institution will often help the mother each month to pay the necessary amount for the child to be taken daily to a crêche while she is at work.

The good done by these institutions is more easily imagined than described. How many infants' lives have been spared, how many women have been rescued, not only from the street, but from desperation, how many have regained their character and made good, honourable mothers, it would be difficult to say. The most admirable devotion is lavished upon the mothers by the lady directors, who always find work for those who are willing to work, look after their children, and often send them back to their homes, however distant, and help them with their advice and influence long after they have left these hospitable shelters.

[*For Discussion on this Paper, see page 435.*]

INFANT MORTALITY: ITS CAUSES AND PREVENTION.

By C. TEMPLEMAN, M.D., D.Sc.

ABSTRACT.

THE conditions which influence this mortality are social and economic, as well as hygienic, and although the latter is the aspect of the question which most forcibly appeals to a Congress such as this, yet in order to intelligently appreciate the subject the others must of necessity receive some consideration.

Two facts will be admitted:—

1. That while the general death-rate of the country has shown a substantial decline, the mortality among infants has not shown a proportionate diminution, but on the contrary has remained either practically stationary or has shown a slight increase.

2. That the problem is mainly one affecting our larger towns, and especially our large industrial centres.

The mortality of infants must always be comparatively high. Children must be born with the requisite vital energy to enable them to accommodate themselves to the changed conditions of life upon which they enter at birth.

Probably 90 to 100 per 1,000 births may be considered a normal death-rate for infants in large industrial centres. Among the most important factors influencing this are some which produce their direct effects mainly through their effect on the mother, such as:—

Insanitary surroundings.

Drunkenness and deficient feeding.

Industrial conditions (where a large proportion of married women go out to work).

Early marriages.

One of the most important factors is ignorance and carelessness on the part of mothers leading to improper feeding, and undue exposure of young

infants, especially when suffering from the common zymotic diseases, such as measles and whooping cough.

The environment of children has also a most important influence on this mortality. Hence it is less in the country than in towns.

Remedies.

Better attention to the condition of pregnant mothers.

Prohibition of employment of women within four weeks of confinement.

Instruction of the elder pupils in elementary schools in personal and infant hygiene.

Distribution of leaflets by registrars giving hints as to management and feeding of infants.

House-to-house visitation by properly qualified lady health visitors, to educate women as to virtue of cleanliness, fresh air, and the proper method of feeding infants, especially advising mothers to suckle their infants.

Establishment of milk depots for sale of properly prepared infants' food.

[*This Discussion applies also to the Paper by* Mrs. C. Hamer-Jackson.]

Dr. H. O. Pilkington (Preston) held that the causes of infant mortality were numerous and varied, and that remedies almost as numerous and varied must be employed if there was to be any hope of combatting this great evil. It might be possible, however, to consolidate those remedies, and if so, he thought that the term "Education" would most fittingly express the result. By that term he meant the education of girls, particularly girls at school, for it was easier to raise a good crop on virgin soil than to remove the roots of deep-seated ignorance and bad habits handed down from others. He thought that if girls were taught the duties of a wife and of a mother, especially as to the correct clothing and feeding of children, the evil which they all recognised would soon begin to assume less alarming proportions.

Miss Mary M. Paterson (H.M. Inspector of Factories, Glasgow) said that she was not at all sure that she had unbounded admiration for the general system advocated by Dr. Pilkington. They must recollect that not many girls, either in Preston or Dundee, remained at school beyond the age of thirteen, and that little impression could be made at that age as to possible contingencies in the then, comparatively speaking, distant future. In both of these towns the girls looked forward as a matter of course to proceed to work in a mill, and did not feel that the home had any special claim upon them. She recollected once talking this matter over with a Lancashire woman who worked in a mill while

paying for the attention and nursing of her children at home. She endeavoured to show this woman that she was actually out of pocket by the arrangement, and was at once met with the question, "You would not have my husband cast it up to me that he's a-keeping me?" She was firmly of opinion that something more was needed to check the evils of infant mortality than the better domestic education of school girls, and the difficulty was to know how to begin and what was desired to be accomplished.

Mr. A. H. Reid (Chairman of the Board of Examiners of the Sanitary Institute, South Africa), having expressed his pleasure at being a representative of South Africa at that Congress, urged that the question of infant mortality was one of extraordinary importance to the community. In that respect the condition of affairs in South Africa was worse than in the homeland, a result due to immigration, and to what he could only characterise as the murder of infants by the coloured races. That was perhaps a hard thing to say, but it was a fact of which a long study of statistics had convinced him; and perhaps he would not be far wrong when he said that the same object, to some extent, underlay the infant mortality of the mother country. During his stay in Glasgow he had been going round with the object of noting the social condition of the lower classes, and he had been particularly struck with the terrible atmosphere in which the people were living. There was a lack of light and a lack of air. People would not even clean their windows, far less open them, and it seemed to him that it ought not to be beyond the resources of sanitary science to invent some means of automatic ventilation for these squalid homes of the people. It might perhaps have to be a form of concealed ventilation, but if successful it would mean the introduction of one of the factors of a healthy life. He thought that perhaps ladies could do more than men in educating the masses on this great question, and he rejoiced to see the interest they evinced in that Congress. The paper contained various suggestions that applied to South Africa, and would not be lost sight of in that part of the world.

Mrs. F. J. Greenwood (Finsbury) said that up to within a few months ago she had been engaged in a working class district in Sheffield, where the infant death-rate was high, and she had found that it was not due to the necessity of married women engaging in work, but she believed it was due to the ignorance of the mothers. This ignorance, combined with the most callous indifference, were the evils they had to combat. As to the question of prohibiting women from working for a definite time before the period of parturition, she observed that it was a most difficult one. For example, who was to decide when that time had arrived? She was also by no means sure of the value of crêches to the community, especially in view of the manner they were at present too often carried on. Not infrequently they might become real centres of infection when their management and supervision were in the hands of

ignorant women. She believed, however, that there were in London nurseries in which mothers could safely leave their children during the day.

MISS I. G. SMITH (London) explained that her work lay almost entirely among illegitimate infants, born under the worst conditions, and many of them in the care of more or less ignorant women. Of the children under her inspection, the death-rate during the last year had been only 50 per 1,000 for all under the age of five years, and 60 per 1,000 for infants under twelve months. While the death-rate in these homes did not allow of exact comparison with that given by the Registrar-General, seeing that most infants were at least a few weeks old when received, this circumstance was really a disadvantage, for many were placed with the nurse-mothers in a very bad, even dying, condition from previous neglect. All were necessarily fed artificially. Considering this result under such drawbacks, she thought that the normal infant mortality of from 90 to 100 per 1,000 births, suggested by Dr. Templeman, should be held as far too high. Her figures were, she thought, a strong argument for systematic inspection now; but the prejudice against rational feeding of infants in the minds of the adult poor was hard to kill, and her opinion was that our hopes must rest chiefly on the rising generation, to whose education in these matters the strictest attention should be given.

DR. J. F. J. SYKES (St. Pancras) also thought that the infantile death-rate should be considered too high at 100 per 1,000 births, and that the statistics from the City of Liverpool ought not to be taken as holding good for the rest of England. What was wanted was a normal infant mortality of about 50 per 1,000 births, and that he would consider as a more reasonable figure. Among people generally he feared there was a tendency to jump to the conclusion that sterilised milk offered a solution of this very difficult social problem. That, however, in his opinion was quite a subsidiary matter. Education was the real need, and he regretted that so far no one had mentioned the excellent system instituted throughout the northern towns of France and in Belgium, the Consultations de Nourisson, where mothers received help and guidance while the girls of the Communal Schools attended and had object lessons. Such experience, with school-instruction added, seemed to his mind to be very valuable. The method of getting the mothers to the Consultation rooms was that women inspectors were deputed to go round and press them to attend with their children. There the children and mothers were examined by doctors and nurses, and instructions were given to the mother how to act, and if she happened to be unable to suckle the child artificial food was prescribed.

DR. S. G. MOORE (Huddersfield) contended that the enormous wastage of infant life was sufficient to warrant the strongest statements as to the importance of the question. He regarded the standard mentioned by Dr. Templeman as a

low ideal. A death-rate of children under one year of age of from 90 to 100 per 1,000 births would be a sufficient improvement in some localities, but in such a place as Rutland the infantile death-rate was only 80 per 1,000 births, and among children living in houses where the rooms were not less than five in number the infant mortality was less than 55 per 1,000 births. There could be no doubt that many deaths among infants were preventable if the parents only took an intelligent interest in their children's condition. He had found that among people generally the word "crêche" was associated with the idea of illegitimacy, and he therefore considered it would be wise to avoid the word in future and to employ a good old Anglo-Saxon term, Day Nursing Room. He noted that Dr. Templeman doubted whether the modern system of life insurance was a factor of any consequence in the production of a high death-rate among infants. No doubt the insurance of infants was in a measure fraudulent, because the insurance companies made an undue proportion of profits on premiums of policies which lapsed, but he did not believe that any considerable body of English people was so debased as to make capital out of the death of their children. He did not, therefore, believe that the infantile death-rate was much affected by life insurance. As to the remarks of Miss Smith about the low death-rate of from 50 to 60 per 1,000 among boarded out children, he took it that these figures would refer to children up to the ages of 6 and 7, whereas infant mortality statistics referred to infants up to one year of age only, and it was during the first, second, third and fourth weeks of life that infant mortality was greatest.

Dr. J. D. Littlewood (Blackwell R.D.C.) considered a death-rate of 100 per 1,000 births was the standard of an idealist, and far too low to be aimed at from a practical point of view. The average infant death-rate in his district for the last ten years was 160·8 per 1000 births, and one of the contributory parishes had an average of 196. After some consideration, he thought that the cause was attributed to the number of early marriages which took place in a district where wages were high, and where the average number of children produced by mothers of the average age of twenty-two years exceeded four. This took place in a colliery district, and was confined to a particular area where new coal fields were being opened out. He also noticed that a very high death-rate invariably followed all newly developed coal fields. As a natural consequence these young and inexperienced mothers knew little or nothing regarding the proper feeding of their children. The gastric disturbances set up by the injudicious administration of unsuitable food were only too frequently relieved by the administration of narcotics. Most of the children were bottle fed, hence the importance of providing a supply of good milk, and a knowledge of how to prepare it, and when to give it.

Miss N. T. F. de Chaumont (London) remarked that it was worthy of note that during the American civil war the infant death-rate went down because there

was little else for the mothers to do than attend to their homes and their children. She believed the same thing happened during the Franco-German war, and these were significant facts. In her own district there were many laundries, and it was a common observation that many of the men there were loafers whose great object in life was to marry one of these laundry girls, who would after marriage continue to work and support the husband. Not much could be done in the way of educating young girls on the question. For one thing, teachers were constantly asserting that the school curriculum was already overburdened, and could not by any possibility be added to without ill results. She thought therefore that one direction in which they might move was that pressure should be applied to curtail the employment of married women, and this might yield good fruit.

DR. H. WILLIAMS (London) threw out a suggestion in regard to a method which he had seen employed with very favourable results, and one that he believed was quite common in parts of France, *i.e.*, the making use of the clergy to educate the women of every congregation on the proper handling and feeding of infants. In a case of which he knew, the clergyman had a monthly meeting of mothers, and hints were given as to how to feed, clothe, and keep clean their children. When the medical officer of health worked hand in hand with the clergyman the results were most gratifying, and he thought that this plan might be more generally adopted in other parts of the country. He was of opinion that in many instances this would be the only way of successfully getting an opportunity of educating the young women of the country.

DR. W. G. WILLOUGHBY (Eastbourne) considered the standard of from 90 to 100 deaths per 1,000 births too high, and agreed with Dr. Moore in estimating the ideal standard at something like 40 per 1,000, if not even lower than that. But there was this to be said for the 90 standard that it was highly practical, and if it were attained there would be a great saving of life throughout the country. With regard to the French system for combating the ignorance that led to so much infant mortality, he was glad to say that the medical officer for Lille had supplied to him, and perhaps could to others, description and information as to the "Consultations de Nourrisson" which were established throughout France.

DR. E. M. SMITH (York) pointed out that it would be well if, in connection with infant mortality, two classes of figures were taken into account, viz., those in which the deaths due to premature birth were included and those in which they were excluded. The difference would represent the pre-natal influences which, in the present position of public health work, were not nearly so much under control as was possible with post-natal influences. No one could entertain any doubt as to the ignorance of many young women upon the duties of a

mother. He had seen more than one mother attempting to feed her child on raw arrowroot. So far as educating school girls on this matter, it was a remarkable fact, in his experience, that school teachers had proved to be amongst the most ignorant as to how to feed children correctly. It would appear that there was room for the more efficient teaching of the feeding and rearing of infants to teachers before they could teach senior girls in schools.

Dr. John Glen (North Riding, Yorks, C. C.) explained that in Yorkshire the county council had taken up the higher education of the community, and their attitude upon this important question was that nurses should be appointed to deliver lectures on the proper feeding and upbringing of the children. This had been done so far with excellent results, and an extension of the system only was required to break down the dead wall of ignorance which was mainly responsible for the deplorable state of things at present.

Mr. J. D. Mitchell thought he was fortunate to follow the last speaker, because, representing Fife and Kinross, he could usefully compare what was being done there with what Dr. Glen had told them was being attempted in Yorkshire. For some time they had employed the medical officer of health to give nursing lectures at various centres, but last year they employed a lady health lecturer, who paid periodic visits to the schools for the purpose of giving instruction. Owing to the overcrowded state of the school curriculum, it was necessary to relieve the ordinary teacher of this branch of study. By Schedule 5 of the Scotch Education Code, the Laws of Health became an imperative study in the senior parts of a school, but if any good results were to follow he thought an expert wherever possible should be appointed to do this work. Their lady health lecturer had delivered over four hundred lectures to the boys and girls in the supplementary courses, to the great benefit of the pupils, and with so much satisfaction generally that the plan was to be continued in the future.

The President (Professor Glaister), in closing the discussion, said the time had come to attempt to focus the remarks of the various speakers. They might flatter themselves that scarcely any aspect of the question had been neglected. He was a good deal amused at the idea of calling in the clergy to their aid, and he had a vision of the agony of a young curate or an old celibate clergyman of the Scotch school in a somewhat trying position. As to the standard to be aimed at in regard to infant mortality there appeared to be much diversity of opinion, due largely to the fact that the statistics for rural districts and for cities varied greatly. It was the case that in all the principal cities of England and Scotland the death-rate of infants was above 100 per 1,000 births, and he also believed that this was the case with France, of which so much had been heard. If they could reach the 100 standard they would be doing exceedingly well, but

he feared it would take them many years to do so. He had visited by night and seen at first hand many of the poorer dwellings, and it was the bare truth when he said that their condition was worse than that of the worst-housed animals; it was hardly an exaggeration to say that the atmosphere of some of the rooms was of the quality that it could be cut with a knife. No wonder that under those circumstances the rate of infant mortality was high. Education, he thought, to be effective must be general rather than along any special line. Dr. Templeman had looked at this very difficult problem from a thoroughly practical point of view.

DR. C. H. TEMPLEMAN (Dundee), in reply, said he knew that a death-rate of 100 per 1,000 was high, too high, but he was of the opinion that in the large industrial centres we should be doing very well if we reached that figure, and he feared it would be long ere we succeeded in doing even that. As to the education of girls, he thought that a good deal could be done for them between the ages of 14 and 20 by means of clubs and evening classes. Special classes on infant feeding had been instituted in London with good results.

THE SANITARY CONDITION OF THE MERCANTILE MARINE.

By WILLIAM WRIGHT, M.B., B.C., D.P.H.Camb.

THE subject which I have undertaken to lay before you to-day is the outcome of my experience as medical officer to the Glasgow Port Local Authority, and is prompted solely by the opinion that sanitary reform is urgently needed in the majority of all vessels arriving in this port.

The subject being a large one, and the time limited, I intend only to touch upon a few of the principal points affecting the health of the crew, whose comfort and surroundings I consider call for first attention, in that their wants are more pressing than those of emigrants and passengers.

A ship, like a house, has its own inhabitants, own water supply, and own system of drainage: added to this it has a constant supply of fresh air. A sailor's life, therefore, should be a healthy one. In those few words I have expressed the opinion of the general public, and I desire now to show how erroneous such a view is, at least in respect of the health of its crew.

Were it possible that the crew could be accommodated on deck, far removed from the effluvia arising from putrescible matter recognised on all vessels, where fresh air is constantly obtainable, there would then be no question but that a sailor's life would be one of the most healthful and invigorating. But unfortunately such highly desirable conditions do not exist in the mercantile marine, and, until much needed alterations have been effected, a sailor's life must be classified in the list of unhealthy occupations.

A ship on the open sea has the solitary advantage of being surrounded by air, free from terrestrial emanations. In all other respects it is placed under unfavourable circumstances, for it combines the drawbacks of inadequate crew space, of ventilation liable to frequent interruption, and of a moist atmosphere acting on vegetable matter subject to decomposition. It seems ludicrous to think that conditions such as overcrowding and extreme vitiation of atmosphere should exist in the midst of the boundless

ocean, yet such is the case. A ship in harbour, though in other respects better circumstanced, is often exposed to the most deleterious emanations from low swampy lands and rich alluvial soils. A seafaring life, moreover, is exposed to great and continuous fatigues, under circumstances otherwise unfavourable to health, and to a certain extent, often for long periods, to the evils of a monotonous existence. Hence the health of seamen and passengers can only be preserved by the most watchful care and attention to the cleanliness, dryness, and ventilation of the ship, the supply of fresh water and of sound provisions, embracing all the elements of a wholesome diet, with suitable clothes and proper change of clothing, with fitting exercise, occupation, and recreation, and facilities for separating the sick from the healthy. The precise means to be adopted to ensure those ends can only be fitly described by those who add to a general knowledge of the principles of hygiene, a special acquaintance with the construction and internal economy of ships.

FORECASTLE.

This is the sailors' quarters.

The amount of space allowed by the Merchants' Shipping Act, 1894, is 12 superficial feet and 72 cubic feet per man. In other words, a space measuring 6 feet in length, 6 in height, and 2 in breadth.

Yet a lamentable condition of things such as this is permitted to continue during an age characterised by the most rapid advances in public health administration on shore. Had the spirit of the Act been strictly carried out, quarters such as *lower forecastles* for the crew would now be swept away, as they are most unsatisfactory, and not possible to keep in a sanitary condition.

The upper, or top-gallant, forecastle is much better. But the deck-house is the ideal accommodation, and meets all the requirements in regard to plenty of sunlight, fresh air, and healthiness generally.

The minimum space provided by law is far too small, and, if strictly adhered to, men cannot possibly live in perfect health. To find the bare amount of space required by law is not very common, but of such vessels still there is a fairly large percentage. The Royal Commission on Labour in 1894 recommended an increased air space of 120 cubic feet for each man. It is not on sea conditions that calculations should be based, but on those which obtain when the vessel is lying in port, where the crew are assembled together in places where they not only sleep but have to live.

It is still not uncommon to find men occupying a forecastle, in which the deck above is much less than six feet from the floor, compelling them

to remain in a bent posture whilst inside. Such a condition of affairs should not be tolerated.

The sides of the forecastle in iron ships contribute towards the production of moisture from condensation of the vapours exhaled by the inhabitants. Sometimes this reaches such a pitch, as to keep the walls constantly streaming with moisture. To obviate this, many vessels have since been lined with wood, and, although it thus offers a dry surface, it only tends towards the accumulation of filth behind. Another method is to coat the sides with finely granulated cork; and of the two methods certainly the latter is to be commended, in that the surface can always be kept clean, and regularly painted. All the vessels of His Majesty's Navy are now, I understand, lined with this material. It should be freely applied over all iron surfaces, both overhead and down the sides of the vessel, as there is no more frequent cause of complaint than the wetting of bedding from condensation.

Sweat Boards, *i.e.*, boards fixed immediately over the bunks, to some extent prevent condensation at that point, but it accumulates at the sides, and the method is not thoroughly efficient.

Bunks should not be built close up to the side, but a sufficient space should be left, in order to permit a man to get round them to clean and paint them. Neither should bunks be made of wood, but of iron, and painted a light colour, of sufficient length and breadth and in two tiers only, the bottom tier being at least 12 to 18 inches from the floor.

In some of the larger liners reaching this port, it is not uncommon to see bunks placed in all available corners, absolutely dark, and little short of coffins. In the remainder of the forecastle, the bunks are all in three tiers, the bottom of the lowest being only two to three inches from the floor, thus preventing the possibility of removing filth, which readily accumulates there.

The position of food lockers also requires more consideration, as they are often found built up against the partition of paint and lamp lockers, and sometimes against that of a closet. Paint and lamp lockers should never adjoin living rooms, unless separated therefrom by an iron bulkhead. Seldom does one ever see a thoroughly tight and efficient food locker, the majority being composed simply of roughly constructed boxes, usually without shelves or doors. The ideal position for food lockers would be a specially constructed apartment outside the sleeping quarters, and well removed from possible contamination from water-closet, lamp or paint locker.

It is to be remembered that the internal fittings of forecastles do not

usually form part of the main structure of a vessel, thus making it easier to obtain the desired reform. For the same reason, therefore, those matters receive little or no attention at the hands of the Board of Trade. They have merely to deal with an empty space, where fore and aft bulkheads, paint and lamp lockers, boatswain's and donkeyman's berths, and food lockers, as a rule, are left to the discretion of the builders, who in this, as in other important sanitary matters, are allowed too much latitude. What is wanted is a *properly recognised authority to supervise the construction of those places, whilst the vessel is in the builders' hands.*

The officer of such an authority would not necessarily interfere with the Board of Trade Surveyor in the pursuance of his duties, but would serve as an adjunct thereto—a recognised person, well acquainted with sanitary principles, to devote himself specially to that portion of the vessel pertaining to the health and comfort of its crew and passengers.

The 6th Schedule of the Merchants' Shipping Act, of 1894, provides that all crew spaces should be—

Securely constructed;
Properly lighted;
Properly ventilated;
Properly protected from weather and sea *as far as practicable*, and
Properly shut off and protected from effluvium which may be caused by cargo and bilge water.

SECURITY OF CONSTRUCTION.

Little comment need be made in regard to this point, as, for obvious reasons, it is usually complied with, only, however, in so far as the general strength of that portion of the ship is concerned; but, apart from this, leakage is frequently complained of through plates and inefficient ports on the ship's side, as also from the deck overhead, the planks having become sprung, as the result of the straining of the windlass overhead in raising and lowering the anchor.

LIGHTING.

On this point alone, without going any further, the Board of Trade subject themselves to condemnation. Few are the forecastles sufficiently lighted, and many of them are very dark. In almost all, the only provision to be found is that of side ports, the rays of light coming in therefrom, being in a lateral direction, are usually obstructed by bunks, etc., and therefore only serve to illuminate that portion of the quarters upon which the light directly falls, leaving the remainder in comparative

darkness. The floors are always in the dark, and dampness and dirt are thus encouraged.

Deck lights.—i.e., Glass prisms, let into the deck overhead, are only available in upper forecastles, but these are conspicuous by their absence.

Deck lights should more frequently be supplied, with benefit.

Companion ways, hatches, etc., cannot be depended on, either as a means of ventilation or lighting, as in bad weather they would be closed.

Ventilation.

Ventilators are too frequently absent, and, when present, are either stopped up with rags, or are placed in positions apparently with little idea as to the purpose for which they were intended. A ventilator is ordered by some local authority, and in it goes at the most readily available spot with regard only to the arrangements on the deck above.

By placing two swan-necked ventilators just inside the knightsheads, where they would be well protected, and connected below the deck to each side of the forecastle by a pipe, and in the passage way, near to the doorway on either side, a cowl ventilator, a constant through current would be induced, and there would be no necessity to close them during bad weather.

It is well recognised that ventilation on board ship is one of the most important points requiring consideration, and one which presents great difficulty in properly arranging.

At best, the amount of breathing space in any forecastle is very limited, and recognising that a healthy adult requires at least 3,000 cubic feet of air per hour, it behoves local authorities to give this matter their urgent attention, in the interest of the merchant sailor.

Protection from Weather and Sea.

Lower forecastles may be considered sufficiently protected from weather and sea, but not so in the case of upper forecastles, where, as already mentioned, leakage is common, due to the action of the windlass, bits, etc.

Effluvium Caused by Cargo and Bilge Water.

The Act reads—"as far as practicable, shut off and protected from effluvium, which may be caused by cargo and bilge water."

The qualification is a saving one, and this provision, therefore, from a hygienic point, is a dead letter, for practically no forecastle is without effluvium from cargo or bilges. The reason is only too evident, and is to be found in insufficiently caulked linings and floors, and defective bulkheads, and is the result of the constant straining of the ship.

The bilges are continually being supplied with water from all parts of the ship, and this water contains decomposing organic matter in varying amount, the gases arising from which are very unhealthy and noxious, and pervade the whole ship in their passage upwards. Oil from the engines, and the washings off manure, all find their way there with resulting offensive odours. The bilges, therefore, should be regularly pumped dry, and frequently washed out with disinfectant solution, and all possible crevices or inlets to sleeping quarters carefully examined and re-caulked, or remedied immediately when found.

Similarly the *Fore-Peak* is a source of nuisance; the entrance to it is through a trap in the floor of the crew's quarters. This hatch is seldom tightly secured, and hence offensive odours find their way readily into the crew's sleeping quarters.

This is another provision of the Board of Trade frequently neglected.

The situation of the fore-peak is thus a bad one, as everything has to be carried through the quarters. The fore-peak should never open directly into the forecastle, but ought to be separated therefrom by a passage leading direct to the hatch.

The *Chain Locker* is another source of nuisance, situated as it is below the forecastle floor. There is always a certain amount of mud adhering to the cable, and consequently we have a damp mass giving off a most unpleasant smell immediately below where the men sleep. This is still further increased when the *pipes* which enclose those chains are defective, a direct communication being thus established between the two places.

All *Chain Pipes* should, therefore, be regularly examined.

Heating.

In almost all the larger liners a proper steam-pipe arrangement is supplied. This, probably, is the best, safest, and cleanest method of furnishing the necessary amount of heat consistent with the requirements of health. It is only in regard to their situation that complaint can be offered. Frequently the *radiator* is placed either in the passage-way between the two forecastles, or at either door, and thus a proper diffusion of heat throughout the whole forecastle is not afforded. If placed in the centre of their quarters and properly insulated more benefit would be obtained.

The old-fashioned *bogie*, which still exists on board the smaller vessels, is of little use. This takes the form of a small square stove, constructed of thin cast-iron, and is either red hot, or choked with ashes, or broken beyond repair.

A circular wrought-iron slow-combustion stove lined with fireclay would be more serviceable, less costly, and supply a steady heat when charged.

Closets.

All sailors' closets on board vessels of the mercantile marine are, generally speaking, abominations. A small space in which a man cannot stand upright, the seat too high, and furnished with a step, which renders its use well nigh impossible; others, simply a long hopper with a plank across; others, trough in shape, filthy and corroded, the majority of the seats broken, and mostly all hand-flushed, and, therefore, choked to the full.

The structure should be sufficient for a man to stand in upright, and should have ample light and ventilation. This latter point ought to be carefully attended to, a port window being supplied, if possible, and the door below furnished with a grating and a few holes near the top. The floor should be of cement, with a good fall outwards. The closet itself should be a galvanized iron hopper, attached to an iron soil-pipe open to the air, the seat to which might, with advantage, be made to lift upon a hinge. The walls of the w.c. also should be regularly limewashed, and kept sweet and clean.

Closets should not be close to sleeping quarters, and, if this cannot be avoided, they should be divided therefrom either by an efficient iron bulkhead, or a double wooden one with a layer of felt between.

Lastly, and most important, all closets should be flushed from the engine, and those which are flushed only by the hand should no longer be tolerated, as they are only open cesspools, and are always neglected.

Lavatory.

It may seem incredible to hear it stated that in very few vessels in the mercantile marine is there such a thing as lavatory accommodation for the sailor. In other words, there is not a washhand basin or bath, where he might wash himself, and yet in all vessels carrying Lascar crews a bath-room is provided.

This provision for Lascars is simple, certainly, in that it is only a square iron compartment, which drains out into the scupper; but not even such is provided for the European sailor.

Some provision, however simple—it need not be elaborate—should be made to enable a man to wash himself. To talk of the want of space for such a purpose is simply to expose a niggardly spirit. If there is room for the cargo, surely there should be at least the barest necessary room for the

requirements of the men who work that cargo into port. A small space is all that is required, with an enamelled washhand basin or two, depending on the number of the crew, and a similarly cheap bath. This could be placed in an iron compartment, like that supplied the Lascars, or, if such could not be obtained, the floor might be cemented or lined with sheet lead and efficiently drained. Nor should there be any difficulty in furnishing a hot-supply in any steamer, for the water, at any desired temperature, is there, and it only wants a pipe to convey it.

I suggest that port local authorities should combine in one strenuous effort to take over into their own hands the sanitary supervision of ships, and displace the Board of Trade from a position which, up to the present, has been nothing short of a sinecure. The officers of the Board of Trade have no knowledge of the sanitary requirements of a ship, why not, therefore, transfer the power to those who are qualified to know. Once port local authorities had obtained such power, a vessel even *during her construction*, and throughout her whole existence, would be kept under surveillance in regard to sanitation by competent officers, and the onus of the responsibility in regard to the health of the sailor would then rest on the shoulders of the proper party, a party prepared to work to do good, and to accept such responsibility.

Cattle Ships.

A large number of such vessels reach this port annually carrying great accumulations of manure, sometimes reaching as much as between 50 and 60 tons of decomposing fermenting refuse, the juice expressed from which finds its way through crevices to all parts of the ship, invading sleeping quarters, circulating round drinking water tanks, and contaminating bilges.

After a ship has been employed in this trade for some time, it becomes thoroughly saturated with this heavy evil odour, and practically nothing can be done to remove it, and yet those same vessels are permitted alternately to act as passenger and cattle ships.

I maintain that a cattle ship should be built specially for the purpose, and should continue to carry cattle only. The present system of conveying passengers in vessels soaked throughout with the concentrated essence of animal emanations cannot be too strongly deprecated, and the strongest of measures ought to be instituted, in order to put an end to it at once.

Conclusion.

It is surprising how few people there are, except those immediately concerned, who have any practical knowledge of the amount of sanitation

or otherwise which obtains in the ships of the mercantile marine. It is a subject that deserves attention, as it affects a class of men whose hardships and privations we daily read about, and the death-rate amongst whom compares somewhat unfavourably with that of other dangerous callings. Crews' quarters can, and ought to be, in such a position on a vessel as to render them habitable under ordinary conditions, and until that is done the main object, from a hygenic point of view, is not attained. With vessels built of all shapes and sizes, the necessity for increased sanitary supervision, *when in the hands of the builders*, is absolutely indispensable. The structural alterations ordered by port local authorities, after the vessel leaves the builders, are frequently indirectly the *fault of the administration*. Moreover, no distinction is made between vessels trading in cool latitudes and those trading under a tropical sun. Again, and this is a point which is frequently overlooked, it costs no more in the first place to provide accommodation for crews, in accordance with sanitary laws, than to follow a contrary course.

There is no reason whatever why port sanitary administration should not reach the same standard as that which exists in Glasgow, one of the first cities of the empire in regard to public health. In the past, little has been done in regard to sanitary supervision in this quarter, and I see no reason why the Glasgow authorities, who have within recent years devoted much time and expense in ameliorating the circumstances and surroundings of many of our poor slum dwellings, should not now devote themselves with the same laudable enterprise and energy to raising the conditions of life—too often insanitary in the extreme, of the floating population reaching this port, to the same level as they eventually intend to attain in regard to our city's congested areas.

I desire to impress on your minds the necessity of radically altering the conditions under which seamen are compelled to live on board many of our British vessels, and, sad to say, some of our largest liners are amongst the worst offenders.

Of course it may be contended by shipping people that, up till the present, those matters have never come under their notice, and that in all cases where complaints were tendered, remedial measures, more or less satisfactory, were at once adopted.

So much is allowed in certain quarters. But I maintain that as they are the owners of the vessels, and have the interests and comfort of their crews in their hands, it is their duty to go further than this, and devote a little of the time which they formerly expended in getting as much out of a ship as possible, towards attempting to render more suitable, comfortable,

and wholesome, the surroundings of their employés—men who, by reason of their rough life and constant exposure to the vicissitudes of all climates, deserve more attention than they have received in the past.

DR. WRIGHT, at the conclusion of his paper, moved the resolution set out on page 453, which he thought should meet the approval and support of all Port Local Authorities.

DR. HERBERT WILLIAMS (Port of London), while agreeing with the principle of the resolution, asked whether the reference was to the Scotch or the English Local Government Boards. It was most desirable that some uniform and universal system should be introduced, and if the resolution were altered to that effect he should have pleasure in supporting it. He had been delighted with Dr. Wright's excellent paper, and with every defect that had been mentioned in the sanitary condition of the mercantile marine he was only too familiar. The President had that morning said the air in some of the slums could be cut with a knife, but he might go a step further and declare that the air in many a forecastle was such that one could lean against it. It was quite true that there were already regulations as to sufficient accommodation for the reamen, and as to lighting and ventilating forecastles, but these were too often either neglected or rendered of no use by the men themselves, and it might be almost said that every forecastle was dark, damp, and dirty. From twelve to fourteen men were frequently herded together, feeding, sleeping, and keeping on their dirty clothes in less space than would be occupied by the half of a fair-sized cottage. Not infrequently cattle were carried on ships which were never originally designed for that purpose, and the bulwarks had to be raised, thus covering up the forecastle, so that the only air which could penetrate to the interior was contaminated by the excreta of the cattle. Not long ago a Commission had sat to consider what could be done to ameliorate the conditions under which the seamen lived. But its recommendations were of such a trivial nature as to be practically useless. The truth was that ship-owners took no interest in their men, and regarded them purely as wage-takers. His practice was to treat as a nuisance those vessels in the Port of London which were defective in lighting, ventilation, &c., and this policy had frequently brought him into conflict with the ship-owners. People generally were entirely ignorant of the terrible conditions under which seamen as a rule lived, and he feared that too often the idea of a sailor's life was an imaginary one.

DR. E. DUNCAN (Glasgow), in seconding the resolution, pointed out that apart from the question of the seamen, much was desirable from the point of view of the passenger in steamships. Even in some of the first-class cabins

several persons had to sleep in places where there was not sufficient room for one. Medical men frequently sent their consumptive patients on a voyage, and these had to sleep as one of four in a small space, with results not merely detrimental to their own condition, but highly dangerous to others. He had constantly cases of sailors coming into hospital suffering from phthisis pulmonalis indeed when a sailor sought admission to a hospital, he almost always found that it was a case of lung affection, owing, no doubt, to the insanitary conditions under which the patient had to live. He was therefore glad that the resolution covered not only the case of the sailor, but also that of the passenger, for both were thoroughly ripe for attention.

Councillor Ritson (Sunderland), speaking from the ship-owners' point of view, said it was well to remember that there were two sets of authorities to be satisfied in these matters; first, the Board of Trade, and then when the vessel came to Glasgow, or any other large port, there were the Local Port Authorities, and it was an exceedingly difficult matter, if not an impossibility, to satisfy the demands of both parties. He begged them not to believe that matters were so bad in the forecastle as Dr. Williams had represented. He himself had had an experience of eighteen years at sea, had been none the worse for it, and was in a position to contradict much of what had been said as to the lack of ventilation and the other ill conditions. They all, surely, knew that however many ventilators might be provided, the men would close up the ventilators, and what could the owners do in such circumstance? It was worse than ridiculous to say that every forecastle was dark, damp, and dirty, and it was likewise unfair to say that ship-owners cared nothing about their men. Professional zeal was all very well, but to make such sweeping charges and assertions was to be unjust. Ship-owners had their own difficulties to contend against, and they were most anxious as a rule to carry out the requirements of the Board of Trade. By all means it was desirable to have one set of authorities, so that there should be something like finality in administration and inspection, instead of there being constant demands for alterations.

In answer to Mr. R. Meyer (Belfast) as to the meaning of the expression in the resolution, "sanitary control of ships during and after construction."

Dr. Wright said that what he intended to convey was that a medical man should have the plans for supervision, and should go over them with a Board of Trade representative, giving an opinion or advice in regard to the sanitary arrangements generally, that he should also visit the vessel during construction to see that such suggestions had been given effect to before the vessel left the builders' hands; and, lastly, after construction it should be the duty of the port medical officer to keep the vessel under supervision and notify the owners of any defects which had resulted through wear and tear, etc.

DR.. HERBERT WILLIAMS (Port of London), remarked that he thought the Board of Trade should supervise the construction and structure of the vessels, but that the Local Port Authorities should have the plans submitted to them as to the forecastle, ventilation, etc. At present the Board of Trade had no medical advisers. It would be a simple matter for the three Local Government Boards to formulate by-laws to be adopted, embodying the general principles of sanitation and health, with regard to both the crew and the passengers.

The resolution was then adopted unanimously in the following form:—"In consideration of the insanitary condition of the Mercantile Marine, this section is of opinion that the control of the sanitary arrangements of ships, both during and after construction, should be vested in Port Sanitary Authorities, and that medical Inspectorships for Shipping should be created on the staffs of the Local Government Boards of England, Scotland, and Ireland to supervise all suggestions from such Port Authorities for the consideration and approval of the Boards, and this section recommends the Council of the Institute to bring the proposition under the notice of the proper authorities."

SHELL-FISH AND INFECTION.

By ARTHUR NEWSHOLME, M.D., F.R.C.P.,

Medical Officer of Health of Brighton.

(Fellow.)

DISCUSSION IN CONJUNCTION WITH SECTION III.

WHEN asked to introduce the discussion on this subject, I had some hesitation in accepting, as I had nothing new to add to what I have persistently written on the subject since March, 1894. Its further consideration appears, however, to be justified and possibly necessitated by several considerations.

In the first place, the repeated and strenuous efforts of the Brighton Corporation and other Local Authorities to secure legislative protection of the public from sewage-polluted shell-fish have failed, Parliament having hitherto not only prevented local authorities from securing local protection, but having also negatived the slight efforts which have been made by the Government to carry through public legislation dealing with this question.

In the next place, the recently issued fourth report of the Royal Commission on Sewage Disposal, contains administrative recommendations which require careful consideration, and the report itself throws doubt on the value of bacterioscopic examination of shell-fish.

Thirdly, although voluntary purification of a certain number of oyster layings has been effected, the public have no means of distinguishing effectively between contaminated and uncontaminated shell-fish, and they cannot reasonably be expected to exercise discrimination; meanwhile large numbers of them continue to suffer from infection by sewage contaminated shell-fish.

Fourthly, the continuance of this state of matters is injurious to the honourable and conscientious members of the trade in question who suffer financially to a very serious extent, and must continue so to suffer, so long as there is no effective machinery prohibiting the sale of sewage-contaminated shell-fish, and so long as the only means of preventing further mischief is for medical officers of health publicly to report the cases of illness, often fatal, which are caused by this means.

I propose first to state briefly the order in which publicity was given to this evil, and the attempts which have been made to provide a remedy. The paragraphs dealing with these points and, subsequently, with a consideration of evidence are taken in the main from a paper by me in the *British Medical Journal* for August 8th, 1903.

In March, 1894, I reported to the Brighton Town Council a series of cases of enteric fever and diarrhœa, which appeared to be due to oysters obtained from polluted layings at Southwick, near Brighton. A copy of this report, with further details based on later experience, is contained in the volume of evidence before the Royal Commission on Sewage Disposal.

Representations as to the state of the oyster layings at Southwick, near Brighton, were made to the Local Government Board during April, 1894, by the Corporation of Brighton, and these representations, and the suspicion that oysters from Grimsby "might have had to do with certain cases of cholera which occurred during the outbreak of that disease in this country in 1893,"* led to the institution of an exhaustive inquiry into the conditions under which oysters and other molluscs are cultivated and stored along the coast of England and Wales.

The inquiry was made by Dr. Bulstrode, and its results were published in the autumn of 1896. Between 1894 and 1896, several reports and papers on the subject appeared; one of these, by Sir William Broadbent,† being especially instrumental in drawing public attention to the danger from sewage-polluted oysters. In each of my annual reports from 1894 onwards I have given details of a considerable number of cases of enteric fever attributable to contaminated oysters and mussels, and in a paper read at the summer meeting of The Sanitary Institute at Newcastle-on-Tyne in 1896,‡ I summarized the evidence on the subject, and the inquiries which had led me to conclude that at least one third of the cases of enteric fever originating in Brighton were caused by sewage-polluted molluscs. It should be added that as early as 1880 Sir Charles Cameron read a paper before the British Medical Association on the possible relation of cases of enteric fever in Dublin to the consumption of specifically-polluted oysters; but this suggestion had been unfortunately disregarded, and, so far as I am aware, no further observations on the subject were published before 1894.

Attempts at Obtaining Remedies.—Having come to the conclusion that one third of our enteric fever of local origin was caused by sewage-

* Dr. Bulstrode's Report on Oyster Culture, p. 1.

† *British Medical Journal*, January 12th, 1895, p. 61.

‡ *Journal Sanitary Institute*, Vol. XVII., Part III, p. 389.

polluted oysters and mussels, a remedy was energetically sought. The Town Council of Brighton was in the first instance advised by the Local Government Board that the suspected oysters should be seized under the powers given by sections 116 to 119 of the Public Health Act, 1875, and it has more recently been informed by the Board that in view of the above stringent provisions of the Public Health Act, and of the belief that a by-law proposed by the Town Council for regulating the sale of molluscs in the Corporation market was *ultra vires*, such a by-law could not be allowed. This lack of appreciation of the requirements of local administration on the part of the legal department of the Local Government Board is unfortunate, and, furthermore, is inconsistent with its action in promoting legislation in the Oysters Bill of 1899.

The above sections of the Public Health Act enable the medical officer of health or sanitary inspector to seize articles of food which are diseased, unsound, unwholesome, or unfit for the food of man. The oysters which the Corporation is advised to seize under these sections present absolutely no naked-eye evidence of unwholesomeness, although they may, judging by past experience, be capable of causing fatal illness. If samples are bought and subjected to bacterioscopic examination, the rest of the consignment has been sold before the results of the examination can be obtained, and the result of the examination of such samples is not evidence in respect of any consignment of oysters from the same source other than the consignment from which such samples were taken. If the whole consignment is seized, its condemnation must presumably be delayed until samples have been subjected to bacterioscopic examination, and the uncertainty of such a procedure—although it has succeeded in several instances in the City of London—is obvious.

Since the above remarks were penned, the above suggestions of the Local Government Board have been considered by the Royal Commission on Sewage Disposal; and in par. 37 of their Fourth Report (p. 21), they state:—

"The suggestion that these provisions might suffice was made to the Corporation of Brighton by the Local Government Board, but we are bound to say that we agree with Dr. Newsholme in thinking that the provisions are practically useless for preventing the sale of contaminated shell-fish."

In 1896 the Brighton Corporation promoted a bill embodying the following proposed powers:

> In case the medical officer of health is in possession of evidence that any person in the borough is suffering from infectious disease attributable

to the consumption of shell-fish supplied within the borough, from any pond, river, or other place, situate within or without the borough, in which shell-fish are commonly kept, bred, or cultivated, and in which pond, river, or other place such shell-fish have been (or are liable to be) exposed to contamination by sewage, or that the consumption of shell-fish from such pond, river, or place is likely to cause infectious disease to any person residing in the borough, such medical officer shall, if authorised in that behalf by an order of a justice having jurisdiction in the locality in which such pond, river, or place is situate, have power to inspect such pond, river, or place, and all shell-fish, matters, and things therein, and if on such inspection the medical officer of health is of opinion that the infectious disease is or is likely to be caused by the consumption of shell-fish supplied from such pond, river, or place, he shall report thereon to the corporation or to the sanitary committee of the council, and the corporation or the sanitary committee, as the case may be, may thereupon give notice to the person by whom such shell-fish is so kept, bred, or cultivated, to appear before them within such time, not being less than twenty-four hours, as shall be specified in the notice, to show cause why an order should not be made prohibiting the supply within the borough of any shell-fish from such pond, river, or place until such order has been withdrawn by the corporation or the sanitary committee, as the case may be, and if in the opinion of the corporation or the sanitary committee, as the case may be, such person fails to show such cause, then the corporation or such committee, as the case may be, may make such order as aforesaid, and the corporation or such committee, as the case may be, shall forthwith give notice of the fact to the sanitary authority and county council (if any) of the district or county in which such pond, river, or place is situate, and also to the Local Government Board. An order made by the corporation or such committee as aforesaid in pursuance of this section shall be forthwith withdrawn on the corporation or such committee, as the case may be, or the medical officer of health being satisfied that the cause of the infection has been removed. Any person refusing to permit the medical officer of health, on the production of such order as aforesaid, to inspect any such pond, river, or place, or after any such order prohibiting the supply of shell-fish as aforesaid has been given supplying within the borough any shell-fish from such pond, river, or place, in contravention of such order, or selling it for consumption in the borough, shall be liable to a penalty not exceeding five pounds, and to a daily penalty not exceeding forty shillings. Provided always that proceedings in respect of such offence shall be taken before the justices of the peace having jurisdiction in the locality where the said pond, river, or place is situate. Provided that no person on whom an order prohibiting the supply of such shell-fish has been made by the corporation or such committee as aforesaid shall be liable to an action for breach of contract if the breach be due to such order. Every person who shall wilfully obstruct such medical officer or other officer of the corporation assisting him in the exercise of the powers of this section shall be liable for such offence to a penalty not exceeding five pounds.

The clause was objected to by the Board of Trade on the ground that the powers, if granted, should be the subject of a public Act, and after a hearing extending over two days, the Parliamentary Committee refused to grant the powers.

In 1897 the Town Council of Brighton adopted a memorial to the Local Government Board, praying for public legislation dealing with this question. This memorial was also sealed by 27 of the 33 great towns and by the London Port Sanitary Authority, and the London County Council also passed a resolution supporting the proposal.

On March 30th, 1899, the President of the Local Government Board received a deputation of the memorialists, and gave them an assurance that legislation in the desired direction would be proposed.

In 1899 the Oysters Bill was introduced by the Local Government Board. A Committee of the House of Lords amended the Bill by substituting the local fisheries committees for the local sanitary authorities as the authority for administering the provisions of the Bill, and the Local Government Board thereupon withdrew the Bill.

The attempts of the sanitary authority of the City of London, in conjunction with the Fishmongers' Company, to prevent the sale of contaminated oysters in the city have done much to arouse public attention and partially to safeguard the public interest.

Recommendations of the Royal Commission (1898) *on Treating and Disposing of Sewage.*—The Report of the Royal Commission recommends the placing of tidal waters under the jurisdiction of Rivers Boards, which shall be joint committees of County Councils, subject to appeal to a central authority. It is recommended that the Rivers Board shall register all beds, pits, etc., for shell-fish, and that the sale of shell-fish for human consumption from places not so registered, or from prohibited areas of foreshore or waters, shall be illegal. It is also recommended that the Rivers Board shall have power temporarily to close foreshore, beds, etc., and to call upon local authorities to provide treatment for sewage discharged by them into tidal waters. In another part of their report the commissioners, however, arrive at the important conclusion that "the treatment of sewage, according to methods at present in use, cannot be relied on so to alter its character as to allow of its discharge in the immediate neighbourhood of shell-fish layings."

It is to be noted that the case of mussels, etc., which grow uncultivated in certain estuaries, and not in special layings, is proposed to be met by the Rivers Board "defining the areas from or within which, in their opinion, shell-fish may not safely be taken for human consumption," the sale from such areas being rendered illegal. It would, in my opinion, be impracticable to administer the proposed powers under this head with any approach to efficiency without an expenditure on inspectors which is unlikely to be incurred, and large numbers of mussels, etc., would be certain to be surreptitiously gathered.

What applies to mussels and cockles, applies to a smaller extent to oysters, and I cannot regard the legal provisions proposed by the Royal Commission as satisfactorily meeting the needs of the case. An Act embodying the recommendations of the Royal Commission would be welcomed, for it would provide considerable safeguards; but it ought to be supplemented by an additional clause embodying the powers sought in the Brighton Corporation Bill of 1896. The latter, in fact, is the more important of the two, and sanitary authorities generally would, I believe, be contented were they to secure the powers asked for by Brighton in 1896.

It is essential that sanitary authorities should be able to prevent the sale in their districts of oysters and other molluscs, when these are shown to be derived from sewage-polluted sources outside their districts, or when they are able to show that these shell-fish have caused cases of enteric fever or other serious illness.

The advantages of Publicity.— So far, apart from the attempts at legislation of the Corporation of Brighton, the much feebler proposed Bill of the Local Government Board, and the vigorous attempts at condemnation by the authorities of the City of London, the chief good done in this field of preventive medicine has been by the aid of publicity. Whenever in Brighton cases of enteric fever have been known to be caused by oysters, the oyster trade has subsequently suffered, and the notifications of enteric fever have greatly declined, and when the scare has been forgotten, enteric fever has again become more prevalent. Every possible means has been taken locally to warn the Brighton public of the danger incurred, including the danger from mussels, which particular mollusc accounts for at least one third of the total cases of enteric fever in Brighton due to shell-fish. The public cannot, however, be expected consistently to refuse to purchase tempting food which is offered for sale. There is an implied obligation on the part of Local Authorities to protect the public against unwholesome and dangerous foods. This obligation in the present state of the law they are unable to meet. Consequently, a serious amount of disease is caused, many lives are lost, and great and unnecessary expense is incurred not only by private families but also on behalf of the rate-payers by Local Authorities in the hospital treatment of cases of enteric fever, owing to the insufficiency of the powers with which Local Authorities are at present endowed.

Evidence as to causation of infection by shell-fish.—The evidence on the strength of which enteric fever, attacks of diarrhœa (resembling those caused by the Gaertner bacillus), and allied illnesses are ascribed to the

ingestion of oysters and other molluscs, requires consideration in connexion with outbreaks of two kinds—(*a*) sporadic cases, (*b*) definite groups of cases. Of the latter the most remarkable are the outbreak among the students of the Wesleyan University, Connecticut, in which 25 per cent. of the students attending an oyster supper were subsequently attacked by enteric fever, and the simultaneous outbreaks following after mayoral banquets at Winchester and Southampton recently reported on by Dr. Bulstrode. In these two outbreaks, out of 266 total guests 21 (all of whom had eaten oysters), or about 8 per cent., suffered from enteric fever, while 118, or 44·3 per cent., of the total guests, all of whom except 3 had eaten oysters, suffered from minor forms of illness. In the two banquets 38 guests are stated not to have eaten oysters; none of these had enteric fever, hence the number of attacks among oyster eaters was 9·2 per cent.

In Brighton the cases ascribed yearly to this cause (21 in 1894, 19 in 1895, 31 in 1896, 30 in 1897, 41 in 1898, 52 in 1899, 17 in 1900, 9 in 1901, 21 in 1902, and 7 in 1903) have in most instances occurred sporadically at irregular intervals and without any demonstrated relationship to other cases. In other words, on the assumption of causative relationship to the contaminated oysters which had been eaten by the patients, the infection must have been frequently present in a certain proportion of these oysters. In the paper already mentioned,* I showed that this fitted in with the epidemiological facts of the case, no long interval elapsing between the occurrence of cases of enteric fever in the Southwick and Shoreham districts and in the inhabitants of Brighton who had eaten oysters or mussels contaminated by the Southwick or Shoreham sewage.

It is obviously much more difficult to prove the relationship between cause and effect in connexion with such sporadic cases than when definitely associated cases occur. The chief evidence on the strength of which I arrived at the conclusion that this fairly steady stream of sporadic cases was caused by sewage-polluted shell-fish may be classed under four heads: (1) Clinical evidence; (2) exclusion of other known causes; (3) topographical evidence; (4) bacteriological and chemical evidence.

These are placed in the order of importance. The first three are, I think, immensely more important and more trustworthy than the fourth, both on the negative and the positive side, though no line of evidence should be neglected.

The clinical evidence is usually as follows: About ten to sixteen days after eating oysters or mussels the patient fails with enteric fever. Very

* Journal of "The Sanitary Institute," Vol. XVII., page 389.

often the definite attack of fever has been preceded by a violent attack of diarrhœa and vomiting about twelve to twenty-four hours after the ingestion of the shell-fish. Either the person who has partaken of the shell-fish is the only one affected, or other members of the family who have partaken of shell-fish at the same time escape or suffer only from minor disorder. Numerous instances of both these are given in my annual reports. In the latter cases it is occasionally observed that the patient noticed something queer about his share of the oysters. Further, it is to be remembered that only a certain proportion of persons are susceptible to infection, that it is not reasonable to assume that every mollusc from a sewage-polluted source contains the typhoid bacillus, and that, even when an outbreak of enteric fever is caused by contaminated milk or water, only a small percentage of the persons drinking these are attacked.

The clinical evidence is supported by the ability to exclude other known causes. Cases of enteric fever due to contaminated water or milk nearly always occur in groups, while those due to oysters and other molluscs are, apart from certain exceptional outbreaks, generally sporadic. In a minority of the cases the possibility of the attack of enteric fever being caused by defective house drains had to be considered. On this point it was noteworthy that the attack generally occurred in the head of the household, who was least at home, his wife and children escaping. As more exact enquiries are made, it will now be generally agreed that defects of house drainage as a cause of enteric fever can be relegated more and more into obscurity. Given, on the one hand, bad drains, and on the other hand the fact that the only person suffering in a given house from enteric fever has partaken of oysters known to have been subject to pollution by sewage, we are bound to decide that the latter are the more likely cause of the attack of enteric fever.

The topographical evidence is as follows: The oysters or other molluscs are traced to their original layings. In these layings, or more often in the market ponds in which they are finally placed before being sent to market, the oysters are found to be subjected to more or less gross contamination by sewage. The gravity of this contamination depends upon the proximity of the sewage outfall to the layings or the ponds, on the set of the tides, and on the size of the population whose sewage discharges at this point. Obviously the risk of the typhoid bacillus being conveyed to the oysters is much greater if they are subject to contamination by the drainage of several thousand persons than if only a small hamlet is concerned in the pollution. In my own experience, which has been concerned chiefly with oysters and mussels from Shoreham Harbour (Southwick, etc.), and

with oysters from Emsworth, there has been no difficulty in stating that there has been sewage contamination of the grossest character.

Bacteriological and chemical evidence has been placed last, as least important. It is not for me to assess the value attaching to the detection of the bacillus coli communis in a given oyster. I am quite clear, however, that if this organism were not found I should brush the certificate to this effect aside as valueless in the face of clinical and topographical evidence that oysters from a given source were responsible for cases of enteric fever. If it were found its presence would be useful confirmatory evidence.

The above remarks as to bacteriological evidence were penned before the Fourth Report of the Royal Commission (1898) on treating and disposing of sewage was issued. The essential point in the part of the report dealing with bacteriological evidence is that the mere presence of bacillus coli does not constitute a justification for condemnation of oysters. With this view, as indicated above, I entirely agree.

[*For Discussion on this Paper, see 466.*]

BACILLUS TYPHOSUS ISOLATED FROM SHELL-FISH IN CONNECTION WITH AN OUTBREAK OF TYPHOID FEVER.

By R. M. BUCHANAN, M.B., F.F.P.S.G.,

Bacteriologist to the Corporation of Glasgow.

THE circumstances attending an outbreak of typhoid fever amongst the holiday visitors from Glasgow and elsewhere to a coast town in the west of Scotland, last autumn, pointed to shell-fish as the probable source of infection. The outstanding facts in the clinical history of the cases were that shell-fish had been partaken of in the raw or partially cooked state during the holiday sojourn there, and that the symptoms of typhoid ensued after the lapse of the usual period of incubation. The outbreak in some measure extended beyond the visitors themselves, owing to the shell-fish in a few instances having been carried home and distributed.

The local conditions are such that at ebb-tide the water recedes from a bay, and exposes a long expanse of sand. The sand is traversed by a stream which courses along the foreshore for some distance before reaching out towards the middle of the bay and gradually distributing itself over the sand. During ebb-tide the sewage of the town is seen to enter this stream at the head of the bay from a large sewer pipe, and that of two public institutions falls into the stream from a small sewer about 200 yards further down. Evidence of pollution appears in this stream and over the adjoining foreshore for a distance of about three-quarters of a mile.

It was from this polluted foreshore and in the neighbourhood of the sewer outfalls that the visitors gathered the shell-fish. The usual gathering ground, it may be stated, is, according to local information, "far out," that is, at a distance of one or two miles, where there is no evidence of pollution.

Specimens of the shell-fish were collected for bacteriological examination on four occasions. They comprised the cockle (Cardium edule), the mussel (Mytilus edulis), the winkle (Littorina littorea), and the "muskin" (local name of Mya arenaria); and were collected during low water—(1) at the sewer outfall and at various distances along the course of the polluted water as far as evidence of impurity was visible, and (2) at a point on each side of the bay about 1 and 1½ miles respectively from the sewer outfall, beyond the range apparently of sewage contamination, and where they are usually gathered for market.

The investigation was undertaken—

1. To determine if the bacillus of typhoid fever could be demonstrated in the shell-fish from the implicated foreshore.

2. To observe the extent to which shell-fish in the vicinity of the outfall showed sewage contamination, and to ascertain at what distance from the outfall they ceased to show evidence of such defilement.

Throughout the enquiry the culture experiments were directed exclusively towards the detection and isolation of the bacillus of typhoid fever and bacillus coli. In the first instance advantage was taken of a medium which has the combined properties of distinguishing the typhoid bacillus from the colon bacillus by difference in the colour of the respective colonies, and of favouring the growth of these microbes while holding most other species in abeyance.

In making the cultures the procedure adopted was followed step by step with the strictest precautions against accidental contamination. The shell was carefully washed by pouring over it, while held in the grasp of forceps, a copious stream of water, and immediately thereafter dried with a cloth; it was opened by the ordinary potato-knife inserted only so far as to divide one adductor muscle and prize the valves apart. The body of the shell-fish was then cut into small portions by means of scissors. Plate cultures were made by spreading loopfuls of the opaque liquid material thus produced from the admixture of the body and pallial fluids on the surface of recently poured taurocholate agar containing neutral-red and crystal-violet. The plates were incubated at 42°C for two days. On this medium and at this temperature bacillus coli was manifest in the form of comparatively large colonies of a pronounced red colour with a trace of surrounding haze in 24 hours, whilst the bacillus of typhoid required 48 hours to develop into small clear colonies of a bluish tint.

It was only in the third collection of specimens—a collection which was made by Dr. Leslie MacKenzie, of the Local Government Board, on 19th September—that the search for the typhoid bacillus proved successful in

four cockles and one muskin. Three of the cockles were "dug up from the mud about 200 yards from the sewer mouth but not in direct stream;" one of them was decomposing, the other two appeared sound. The fourth cockle, which also appeared sound, was taken "from the surface" at 600 yards from sewer mouth. The "muskin" from clay was at 600 yards from the sewer. It is a remarkable fact that in these shell-fish the typhoid bacillus appeared in great numbers and almost in pure culture, and that the bacillus coli was represented by one or two colonies only. It was estimated that a single loopful of fluid from one of the cockles yielded 7,000 colonies of bacillus typhosus, and had anyone swallowed that cockle in an uncooked state, he would have received in one moment a dose of somewhere about 3,000,000 virulent typhoid organisms. In the culture from another cockle, where it was possible to make an approximate estimation, the numbers were about the same. The bacillus thus discovered was found to have all the microscopical and cultural characteristics of the typhoid bacillus. On inoculation it proved fatal to guinea-pigs within 18 hours; further, it gave the characteristic re-action with human typhoid serum and with serum obtained from a typhoid immunised guinea-pig. The finding of the bacillus in such numbers, and in so many individual shell-fish, naturally demanded repeated and searching proof of its identity. It was accordingly subjected again and again to a long series of the most crucial culture tests and to repeated serum tests in dilutions as high as 1–10,000, and always with the result of proving its identity in every respect with the bacillus typhosus obtained from a case of typhoid fever.

The existence of the bacillus in shell-fish almost two months after the time when the human infection took place is a point of great interest from an epidemiological as well as a biological point of view. It widens the scope of enquiry in such epidemic outbreaks, and it raises the question as to what special circumstances enabled the bacillus to remain thus long in external nature, and retain all its characteristics intact. It can only be suggested as a probable explanation that in the cockle and the "muskin" it finds a suitable host for its growth and its protection against destructive rivals.

Coming to the second point of the inquiry, namely, the extent to which shell-fish in the polluted area showed evidence of sewage defilement, it may be said in a word that almost every individual shell-fish in the four species examined, yielded evidence of such defilement by the presence of the bacillus coli. Cultures of this bacillus were found to have a high degree of virulence, killing guinea-pigs within 18 hours. On the other hand, the shell-fish obtained at a distance of one to two miles

from the sewer outfall were entirely free from bacillus coli and allied organisms, a fact which may be taken to indicate that they were beyond the range of sewage contamination. It may also be taken as an indication that shell-fish under normal conditions do not contain this micro-organism.

To sum up, the investigation proved (1) that the bacillus typhosus was present in shell-fish from the area implicated; (2) that the shell-fish from the implicated area were all more or less contaminated from sewage; (3) and that shell-fish at a distance of one to two miles from the sewer outfall were entirely free from evidence of contamination.

[*This Discussion applies also to the Paper by* Dr. Arthur Newsholme.]

Lieut.-Colonel Davies (Royal Army Medical Corps), said there were two remarks he would like to make on Dr. Buchanan's very interesting paper. Firstly, it was very curious that the bacillus typhosus should have been found in such abundance and that bacillus coli should have been almost absent. There could be no doubt from the photographs they had seen that it really was bacillus typhosus; but, as of course, bacillus coli was so infinitely more abundant in sewage matter than bacillus typhosus it was very curious that the bacillus typhosus should have been found in such large proportions and should not have died out at all, but should have retained its proper cultural characteristics. It opened up an extremely important point in regard to the fact that the body tissue of the shell-fish was apparently a cultural medium for the propagation of bacillus typhosus. Secondly, it was also very interesting that bacillus coli was not found in the shell-fish taken at a distance of two miles from the outlet, because Dr. Eyre, the pathologist at Guy's Hospital, whose communication in the *British Medical Journal* some time back was read with interest, found in a large number of cases not only in shell-fish, but in real fish, and in shell-fish taken from a longer distance than that —many miles from any shore—bacillus coli obviously present and in large quantity in the shell-fish taken as a whole—that was he presumed derived from the intestinal part of the fish. Certainly it had been found in many instances in the intestines of shell-fish, and therefore it would be in the body taken as a whole. It was curious that it was not so in this instance, but they had sufficient justification for believing that it was really the case. He felt that these two points were both worth further investigation.

Dr. Knight (Glasgow), said that he and Dr. Buchanan were associated in the inquiry which was made, and he might refer to a few of the features which led them to recognise shell-fish as the source of infection before any direct evidence had been obtained from bacteriological research. About a year ago, shortly after the Glasgow Fair holidays, they had two cases of typhoid

fever notified, and they learned that the people had recently returned from the coast and sickened of enteric shortly after. This seemed suspicious, and they instituted inquiries into all cases of fever, and found that a fair number were in respect of those who had been visitors at this same coast town. He was commissioned to extend the inquiries beyond Glasgow, with the result that he found Glasgow and its adjacent boroughs, forming what one would call Greater Glasgow, seemed to be the only area affected. In each borough the class of persons affected were the same—the decent artisan class who took their holidays at the Fair season. Then a curious feature was discovered. They found that the cases could be classified into groups. It was not sufficient, of course, that the patients should have been resident at the coast town during the probable time of infection to demonstrate that they had actually got their infection from shell-fish. It required something further, and that evidence was obtained from one striking group in Glasgow and from even a more conclusive one in one of the adjoining boroughs. From the inquiries they made, everything seemed to point to a satisfactory water supply and milk supply and drainage in the coast town to which the people went. The only thing in common was that the people had been eating shell-fish. It was of some little interest to find that in each the shell-fish was the cockle. Doubtless one reason was that the mussel and the large clam were not eaten in a raw condition. They found, therefore, that all concerned had been eating cockles in a raw condition. Some of them had also eaten of other varieties of shell-fish, but mostly after boiling. The raw cockle was the one constant factor. In addition to this they had a second group of cases where the individuals who were attacked had not been near the coast town in question at all. The infected matter had been brought up from there and they had partaken heartily of the shell-fish from the coast towns. That their infection was in reality due to eating the infected shell-fish was fairly demonstrated by the dates at which they sickened. Just as they found that those who had been to the coast town sickened within a given interval after having eaten the shell-fish, so they found in the other cases that the illness took place a week or ten days after taking the shell-fish. One curious fact struck him in making the inquiry, which was that in comparatively few instances had any symptoms occurred immediately after the ingestion of the shell-fish. They knew that people in general exhibited a peculiar idiosyncrasy towards shell-fish, but in the cases of those who actually developed enteric fever these symptoms seemed to be mostly absent. Whereas in other members of the family who did not develop enteric fever, but who had eaten the shell-fish, very often within twenty-four hours after having done so they were attacked by violent diarrhœa and sickness. This was interesting as it seemed to show that this served to get rid of the germ, and thus they were spared a subsequent attack of enteric; in the case of the majority no such symptoms occurred immediately after the ingestion of the shell-fish, the germs were left to multiply slowly in the intestines, and eventually enteric fever came. These cases were particularly interesting as they formed a well-defined group, and

from the distribution throughout the city itself it was quite clear that any local focus in the city could be put out of court. They were distributed uniformly through the city, and they had one feature in common, which was that they had all eaten raw cockles from this particular place; the majority having resided in the place, and the small minority having consumed the cockles brought from the coast.

Dr. H. Williams (Port of London) thought it was no longer necessary to demonstrate or to prove the fact that there was danger of contracting enteric fever from sewage contaminated shell-fish, and it was also the fact that the cockle was a much more dangerous form of shell-fish than any other. Dr. Klein had shown by laboratory experiments that when cockles had been placed in sea-water infected with a certain proportion of the organism of typhoid fever, in the course of a few days cockles taken from that water and examined bacteriologically had been shown to contain an enormous number of germs of the organism of typhoid fever, thus proving that the organism of typhoid fever could develop and multiply within the intestinal canal of the cockle. In London this question had received a considerable amount of attention. Southend had spreading away on its coast a number of sand banks from which large quantities of cockles were collected. It used to be the practice of fishermen to collect cockles from these sand banks, and take them to Leigh. They were taken by fishermen to this place, and according to the requirements of the market they were boiled there and sent up to London. If the demand was not brisk they were stored in the waters of a little creek there until the market price might be better. The water in that creek received the sewage effluent from the town of Leigh after it had been treated by means of septic tanks. He collected specimens of cockles, mud, and water from that creek and they were examined by Dr. Klein, who found that the water and mud contained enormous quantities of bacillus coli. To use Dr. Klein's own words the water was nothing more or less than diluted sewage. In the cockles taken from the creek he also demonstrated the organism bacillus coli in large quantities, and in two specimens out of six he also demonstrated the organism of enteric fever. It was a town of about 4,000 inhabitants, and in the year 1902 the number of cases of enteric fever notified to the medical officer of health, as occurring in Leigh, was 40 cases, or one per cent. To carry on the story a little further, cases of enteric fever occurred at Camberwell and in other London boroughs. Those cases were traced, and they found in certain instances that those attacked had consumed cockles which had been purchased within the City of London, and which cockles had been boiled at Leigh, and sent to the markets in London. Samples of these cockles were taken after a so-called process of boiling had been gone through, and it was found, although it was stated that they had been boiled for three minutes, yet that was not sufficient to sterilise the interior of the cockle, and that in nearly every instance they could, by cultivation, prove the presence

of large numbers of bacillus coli. He was interested in the remarks of Dr. Buchanan as to the fact that at a distance of one mile or two miles from the sewer outfall no organisms of enteric fever were found. That was a point which in the future would have considerable practical interest. As they knew, the Royal Commission on Sewage Disposal, which had been sitting in London, had issued a report, and they recommended that steps should be taken to register shell-fish layings, and that it should be in the hands of certain recognised authorities. It was obvious that the authority which was to register these shell-fish layings, from which shell-fish might be taken and consumed with a fair amount of impunity, would require some practical knowledge as to what would lead them to register the layings, and it seemed to him that this would have to be done largely on topographical grounds, such as the position of the bed, and the distance from the nearest sewer outfall. Perhaps others present might have evidence to offer in that direction, for it would be important to lay down some approximate distance at which they might, within reason, state that shell-fish might be collected which would be safe for consumption.

DR. A. K. CHALMERS (Glasgow) quite agreed with Dr. Williams's opening statement that evidence had proved that shell-fish might be a source of infection, and the question which remained was how recurrences of these outbreaks were to be prevented. Dr. Newsholme, in his paper, traversed the recommendations of the Royal Commission on Sewage Disposal, and Dr. Williams had referred to the difficulty of making a standard for the registration of these shell-fish layings. In Scotland, so far as the River Clyde was concerned, they had no oysters but they had shell-fish. Not only in the village of Gilphead, which was the scene of the outbreak last year, but elsewhere they were able to locate enteric fever in people who had visited one or other coast places. Loch Gilphead was one of the places largely resorted to in holiday time by the people of the industrial villages of Lanarkshire, and there was evidence that not only Loch Gilphead but in other places where the people collected, gathered, and ate shell-fish enteric fever resulted. The difficulty was that these shell-fish were not owned by anyone. Anyone going along the shore might pick them up and eat them. They did not register these layings; how were they going to protect the occasional visitor? He was afraid that Dr. Newsholme's present conclusion was correct, that at the present moment there was a recognised amount of disease caused by shell-fish, which they were unable to prevent; that was they had no power to prohibit people ignorantly collecting shell-fish. In Loch Gilphead the natives were perfectly aware that the shell-fish should not be eaten, but the unfortunate worker who went to the sea-coast did not know natural history, and when he saw a muskin lying on the surface he thought it an easy prey, and promptly consumed it. If the Clyde villages were to be protected, it seemed to him that no sewage must be allowed to be discharged into the Clyde or its tributaries in an unfiltered state. So far as the present methods of treating

sewage were concerned it was not possible to obtain a purified effluent that was safe to feed shell-fish with. Registration in Scotland would mean that each local authority along its foreshores should be compelled to exercise an amount of care necessary to ensure that whoever consumed shell-fish would be protected from taking such as had been contaminated with sewage.

Mr. R. W. Edwards (London) asked how far the experiments and practice they had had in regard to polluted shell-fish had been in agreement with the remarks of Dr. Knight. In London they had the power, through the Fishmongers' Company, of prohibiting the importation of polluted fish, or fish dangerous for food, to the markets of London; but a difficulty arose in dealing with the question through the Fishmongers' Company in the case referred to by Dr. Williams. The Fishmongers' Company contended—and he thought rightly—that if the cockles were submitted to the process of boiling, that destroyed the germ in the cockle so far as its injurious effects might be towards the human beings who consumed it. No one, he thought, would deny that that was a fact, but the process of boiling these cockles was such that it was just possible when the bag of cockles was put into the receptacle to boil the heat did not penetrate into the centre of the parcel, and therefore they had to insist on the Fishmongers' Company prohibiting the supply of cockles from certain parts they knew to be polluted with sewage on that ground. He thought Dr. Williams would agree with him that if the cockles were submitted to the process of boiling it would destroy the germs in them.

Dr. Vacher (Cheshire) felt there was one phase of the question which had not been brought before the meeting, the limited power possessed by local authorities for dealing with the matter. Some time since, at the mouth of the Mersey, a local authority on the Cheshire side—the Wallasey Urban District Council—had reason to believe that certain mussel gatherings there were dangerous. He made representations to them, and steps were taken to the extent of putting up notices. Warnings were given to cockle gatherers against taking shell-fish from this particular area, as it was believed that shell-fish gathered here had produced typhoid fever. Notices were put up to draw the attention of the passers by, and representations were made to the Clerk of the District Council that he should take steps to enforce the prohibition. The Clerk said, that in looking up the matter, he found that although they had the power to put up notices there was little power to enforce them, and if they wanted anything done, they must approach the River Authority, and get them to pass a sort of by-law in connection with this particular bit of the shore. Representations were accordingly made to the River Authority who agreed to do this, and the difficulty was got over. But it was a real difficulty, and many rural districts were hardly aware how exceedingly limited their powers were with reference to this matter. As regarded the danger from eating shell-fish boiled, Dr. Vacher

was rather surprised when that theory was first propounded, knowing how easily bacillus typhosus was sterilised. In order to make milk quite safe they were able to say that if they brought it to a temperature some degrees short of boiling, it was sufficient to sterilise the bacillus typhosus. The explanation given by Mr. Edwards was the only one that could be received by medical men. When cockles, said to be boiled, caused typhoid fever, it was very certain that a number of them did not reach a temperature of 60 centigrade.

MR. SCHOFIELD asked whether there was much typhoid fever in the town where the cockles came from—Loch Gilphead?

DR. KNIGHT replied that so far as he could gather there were no cases at all.

MR. SCHOFIELD said it seemed rather extraordinary that when the typhoid bacillus was found in such considerable numbers there should have been no origin from the typhoid excreta.

DR. KNIGHT said there was no recognised typhoid fever there.

MR. SCHOFIELD observed that it was in marked contrast to that mentioned by Dr. Williams at Southend.

DR. MOORE (Huddersfield) thought that the reply of Dr. Knight opened up a wide and important field. If there was no enteric in the comparatively small place from whence the small stream derived the sewage which flowed over the cockle beds, then one's whole assumption of the origin and cause of typhoid must be enlarged and altered. He ventured to throw out the suggestion that it was almost worth the while of Drs. Knight, Chalmers, and Buchanan to ascertain, if it was possible at this date, definitely whether or not cases of typhoid fever were known to exist in the drainage area of the small stream which flowed over the cockle beds.

DR. KNIGHT said these inquiries were made at the time by the Medical Officers of Health, and not only for the small area concerned.

THE PRESIDENT (Prof. Glaister): With about 2,000 or 3,000 population?

DR. KNIGHT said the medical officers all over the county were asked the specific question, if there was any enteric fever in their districts. His own impression was that they did not recognise any.

MR. COUNCILLOR STEELE: Is it not the fact that a number of people in these places do not take the same interest in shell-fish that the Glasgow people do? Whenever a Glasgow crowd goes to the coast they gather cockles, whereas the people in the district seldom indulge in such luxuries.

The President said it was obvious that this was a case of the pollution of shell-fish which was well authenticated. In this particular instance also he thought there was no doubt that infection did take place. The question which Dr. Moore had raised was very pertinent, but apparently no one could find cases of enteric in the locality. In Scotland, as in England and elsewhere, there were certain practitioners who did not recognise enteric fever, but recognised it as what they called continued disease, and consequently they got it under the name of continued fever.

Mr. Schofield: Were there any cases of continued fever?

Dr. Knight: I asked for information on all these points, and was informed, "No."

The President said that here they had all the distinctive features of enteric fever. They had cases clinically unrecognisable from enteric fever. There was no doubt it did come from shell-fish, and it was time something was done by the government to protect the population against it. They knew the Government had tried to do it. They would see from Dr. Newsholme's paper that a Bill was introduced into Parliament. The Local Government Board introduced the Oyster Bill in 1899, but because of some amendment introduced they withdrew the Bill. Of course there was still the recommendation of the Royal Commission on Sewage on the subject, on which it might be possible to build up a Bill in the future. But they had not only to deal in this connection with local foreshores. They had to deal also with polluted rivers which were entering the vicinity of these foreshores. As a matter of fact there were many cases of highly polluted rivers which threw their contents into the sea, and he would point out that the shell-fish, like the higher classes of fish, was extremely fond of fat feeding, and it got that in sewage water. He had had a good deal to do with cases of river pollution, and in the most recent case he was investigating he found a very extraordinary thing, which was that in a large famous classical river in Scotland, which had been highly polluted, millions of these shell-fish were to be found. Whenever they got outside the sewage boundary these shell-fish began to diminish in number, but in the sewage they were growing fat and breeding freely. It seemed to show that when they found them living and breeding freely, that they were in polluted but well oxygenated water. Oysters, cockles, and the minor forms of shell-fish would luxuriate in polluted rivers containing not only *coli* but *bacillus typhosus*. They had to take into careful consideration the effluents from purification systems of sewage. Two years ago he had under observation a stream which was alleged to be polluted by the effluent from a bacteriological system of sewage, and an action was laid in the law courts of the country, and for over a year he made analyses and bacteriological examinations of the water. In every case within one and one and a half

miles of the effluent entering the stream he found plentiful evidence of coli, and even in that stream they found fresh water molluscs growing freely. These were points which had a large bearing on the question, and he trusted that pressure would be brought to bear on the Government to deal with it by legislation in a satisfactory way.

DR. BUCHANAN expressed his pleasure that the discussion had brought out so many points especially interesting to those concerned in the administration of public health. Col. Davies was surprised, and very rightly so, that the bacillus coli appeared almost absent from the shell-fish in which the bacillus typhosus was found. That fact was to him a very surprising one, for they had these shell-fish taken side by side with others which showed bacillus coli in great abundance. There was some truth underlying this which for the moment he could not understand. Perhaps there was some connection in the fact that those who developed typhoid fever had no preliminary symptoms, whereas those who had taken the shell-fish and did not develop it had a severe attack of *gastro enteritis*. It was just possible that might be attributable to bacillus coli, whereas shell-fish containing the bacillus typhosus, not having this virulent organism, did not produce this preliminary illness. He offered that as a possible explanation. He did not rely entirely upon one test to determine the presence of bacillus coli in the shell-fish taken from a distance. He used two tests, and they both gave identical results side by side. In that way he confirmed the fact in a very satisfactory manner.

CONGRESS AT GLASGOW.

SECTION II.

ENGINEERING AND ARCHITECTURE.

THE SUPERVISORY CONTROL OF WATER SUPPLIES.

By JAMES ROBERT KAYE, M.B., D.P.H.
(Fellow.)

IN introducing a discussion on this subject, I take it there is no need to dwell on the actual local details of control. As sanitarians we are all of us agreed on the vital importance of having a pure water supply and of scrupulously guarding the same when acquired.

It is the much broader, and even national, aspect of the water question which concerns us to-day, and I have to invite you to consider whether the existing state of things in this country is anything approaching satisfactory.

The legal duty of providing a water supply usually rests absolutely on the individual sanitary authorities, of which there are no less than 1,800 in England and Wales. Obviously a very large proportion of these authorities must look beyond their own area for the source of supply, and in doing so they naturally seek to appropriate that which offers the best bargain from their point of view. Thus it comes about that in many parts of the country there has occurred something like a scramble for the best available supplies. True, the schemes are submitted to Parliament, where some consideration, within defined limits, is given to the interests of those specially represented; and it must be admitted that of late a very great improvement has been brought about by the recognition of the abstract rights of the localities and streams sought to be depleted, and

Note.—The Proceedings of the Section commenced with an Address by Prof. Henry Robinson, M.Inst.C.E. (*see page* 270).

of the reasonable title of the people *en route* to take a supply from the conduits. But something has been missing all along, and there is now a wide and growing feeling that some form of supervisory control is necessary to apply to all future schemes, if not to many of those already carried out.

SURFACE WATER SCHEMES.

A study of the present situation in populous localities, where urban communities are in close proximity, frequently shows that the largest or more enterprising of these communities have already appropriated the most convenient catch-grounds, and the outlook of others for the future is often serious. Of course, arrangements exist for the sale of water in bulk on statutory terms to certain neighbouring authorities, but we frequently have the spectacle of a new centre springing up possessing no legal right to a share, and having to purchase their water at second or third hand on terms which they do not like, but which they find themselves compelled to accept.

The available catchment areas seem to have been given out on the principle of first come first served, and whilst some of the first comers have secured what naturally should have gone elsewhere, others have staked off far more than they were likely to require, with the result that either there is a great waste of resources, or probably they are able to dispense one of the first necessaries of life to half a county, their customers having no voice in the management or control of the supply.

UNDERGROUND SUPPLIES.

The position regarding supplies drawn from underground is sometimes even worse than those just referred to, for the law does not admit any inherent or acquired title of the sanitary authority to the underground water in the district. Every proprietor is at liberty to bore down and pump away the water without limitation, even though his action deprives his neighbours of their supply. Similarly a large water company or authority may rob a whole district of its underground water, and until lately there has been but little thought of giving protection to local interests. In some colliery districts, too, it is reported that the modern system of continuous pumping to keep the workings free from water has resulted in the permanent tapping of the beds from which the local supply was wont to be derived.

REMEDIES WHICH HAVE BEEN SUGGESTED.

During the last five or six years the injustice of the present system of allocating water supplies has become increasingly apparent, and has given

rise to numerous protests. I propose to give briefly a few of the suggestions which have been made, without expressing my personal opinions as to the best way of removing the present difficulties, and at the same time securing a more uniform and complete oversight of the day-to-day conditions affecting the supply of drinking water to the people.

In June, 1899, the British Association of Waterworks' Engineers passed the following resolution :—

> "That in the opinion of this meeting of the British Association of Waterworks' Engineers, it is essential in the public interest that the water supply of the United Kingdom should be subject to the general control or supervision of some independent, duly authorised, and properly qualified body or department, for the following among other reasons :—
>
> 1. "That the water supply generally is a subject of national importance, and ought to be under national control or supervision."
> 2. "That the present system of local control, while excellent in many cases, depends too largely on the varying constitution of the local bodies now administering the water supplies."
> 3. "That there is not that amount of combination for the purpose of water supply, which is desirable in order that the best and most economical use may be made of the available sources of supply."
> 4. "That there is an immediate necessity for dealing with the allocation of gathering grounds and other sources of water supply on a comprehensive and equitable basis, independent of local and other selfish interests."
> 5. "That the smaller local authorities cannot, except at a prohibitive cost, sufficiently protect the interests of the communities dependent upon them for their water supplies."

About the same time the County Councils' Association appointed a committee to consider the present position of the law as affecting sources of water, and after collecting evidence by circularizing authorities all over the country they conferred with the Association of Municipal Corporations. Eventually a Bill was drafted (but never brought in) to give the Local Government Board power to create water authorities, consisting of representatives of numbers of sanitary authorities in suitable groups. Such water authorities were to be charged with the supervisory control of the water appropriated in their area, with power to impose restrictions and to demand supplies for such of their constituents as were in need of the same ; also to prevent the depletion of springs and wells by pumping, and to group together minor authorities for the purpose of obtaining and distributing water.

The same question in its different phases has also been considered by The Sanitary Institute, and by various other bodies and County Councils who have passed resolutions expressing the urgent need for action of some kind.

In October, 1902, the President of the Local Government Board received a deputation from the County Councils' Association, The Sanitary Institute, the Association of Waterworks' Engineers, and the Underground Water Preservation Association. After hearing their views at length, Mr. Long agreed as to their importance, but objected to set on foot any special action pending the Report of the Royal Commission on Sewage Disposal, which he regarded as dealing with a subject closely connected at several points with the question of water supplies.

Subsequently, in 1903, the Local Government Board forwarded to the Sewage Commission an account of the Conference just mentioned, with the idea that the Commission might make some recommendation dealing with the whole subject.

Then in March, 1903, the Sewage Commissioners issued their third report in which they recommended that the new central authority proposed to be established for dealing with questions of sewage treatment should also be charged with the supervision of sources of supply, and that it should be the duty of the proposed Provincial Rivers Boards to inspect and examine all public water supplies as to purity and protection; also to deal with such questions as the abstraction of water from one district for the supply of another district to the detriment of the former. The only alteration which the Commissioners think would be entailed by the placing of this vast amount of additional work on the proposed Rivers Boards is the extra appointment of an epidemiologist on the suggested central authority. Each Rivers Board district is to include as far as practicable the whole of one or more watersheds, and the first duty of the central authority will be to ascertain what grouping of areas would be the most effective and then to take steps to constitute the Rivers Boards accordingly.

Review.

In discussing these various proposals for the supervisory control of water supplies, we may perhaps obtain some guidance from the constitution and practice of the Derwent Valley Water Board, which is a unique authority, established by Act of Parliament in 1899 to control and allot the gathering grounds in the upper reaches of the River Derwent on the borders of Yorkshire and Derbyshire. This board was created because a number of distinct authorities were competing for the supplies in question,

and Parliament recognised that all had interests therein and that economical joint distribution was advisable. The Board consists of representatives of Sheffield, Leicester, Derby, Nottingham, and the Derbyshire County Council. Its duties are to apportion out the water in fixed ratios to each of the Corporations, and power is given to the County Council to create water districts by grouping together small areas that may be in need of water. Any such water districts are entitled to demand from the combination a supply of water in perpetuity.

If, instead of this arrangement, the recent suggestion of the Sewage Commission had been available, the control of this particular water supply would presumably have been in the hands of a Rivers Board on which several of the Corporations would have been unrepresented seeing that they are not within the immediate watershed; yet Parliament has properly admitted their right to a share in its control. Or, if the particular Rivers Board were so comprehensive as to take in the area represented by the present Water Board, then its territory would embrace all the Midlands, and any establishment which could deal in detail with the sewage problems of so vast and important an area would be incapable of supervising also the equally if not more important questions of water supply.

In other words, the interests of the Rivers Boards and those of the water-seeking communities are not necessarily coterminous, and the connection of the former with underground waters is indeed remote. As to the Sewage Commission, it was not constituted with the view of making recommendations on the control of water supplies, and I have heard it said that the subsequent placing of such duties on them is like asking a burial board to legislate on the care of infants.

It would appear that the Sewage Disposal Commission do not propose to further consider the question of water supply after their recent recommendations for placing this matter under the control of the proposed Rivers Boards. This easy solution of the manifold difficulties surrounding the supervisory control of water supplies was arrived at by the Commission within two months of the matter being referred to them, and is evidently regarded as complete. On this the County Councils Association have decided to repeat their request for a Royal Commission to be appointed to inquire into the whole of the water question *apart from the prevention of pollution* of streams, a request which has my full sympathy.

Whatever class of supervising authorities be created, they must possess or be able to acquire complete and detailed local knowledge of the area under control, so as to be able to carefully weigh the interests of all parties concerned in the protection and allocation of the water supplies in

that area; not merely taking cognizance of the *contending* authorities (as is the case at present), but duly appreciating the rights of silent parties, and even giving a thought to the possible needs of non-existent communities which the future may see. The supervising authorities must be large enough to take a broad and complete view of the situation, yet not too large to undertake the co-ordinating and supervising of the actual local or parochial control, which is so badly needed, especially in some of the following directions:—

1. To supervise the collection, storage, and distribution of water supplies, with power to inspect all works. To direct measures for the better husbanding of supplies where necessary, and to promote economy by suitable combination of districts. To see that there are no unauthorised departures from schemes as approved. To frame regulations for the protection of gathering grounds, and to enforce the exclusion of particular supplies where necessary. To approve of emergency measures in the case of scarcity or unforeseen eventualities.

2. To establish and carry on a regular system of comparative examination (physical, chemical and bacteriological) of all the public water supplies in their area, and thus gradually build up standards for each supply. Experience has shown, over and over again, that the significance of analytical data is relative and not absolute; that is to say, the early detection of slight mischief can best be made by comparison with previous regular records of the same supply.

3. To supervise all means for the corrective treatment of each supply, *e.g.*, storage, filtration, softening processes, chemical treatment for the prevention of plumbo-solvent action, etc. As things are at present these processes usually give excellent results when first established, but changes in the staff or personnel of the water authority often induce corresponding changes in the efficiency of the treatment, or considerations of finance and local politics bring about laxity and irregularities of which the consumers of the water remain in blissful ignorance. The recent report of the Local Government Board on lead poisoning has clearly shown that this single phase of the supervision of water supplies is an urgent matter of no little magnitude, affecting both old and new supplies in many parts of the country, and having no connection whatever with the function of a Rivers Board.

4. To keep a watchful eye on the health statistics of the various communities within the area, with a view to studying the influences

of the water supplies upon health at all seasons. To investigate any disturbances observed, and to apply remedies.

5. To group together areas for the purpose of distribution, and to secure water for them on equitable terms, and generally to represent their interests in obtaining adequate and permanent supplies, and preventing the depletion of their natural sources by outside districts.

6. To regulate, supervise, and enforce where necessary the supply and use of water for other than domestic purposes in the interests of the public health, *e.g.*, sewer flushing, road watering, etc.

The machinery to be established must be powerful, and at the same time delicate, and, in designing it, a careful consideration will have to be given to a host of difficulties, acquired rights, and contending interests of manifold complexity.

Having indicated a few of the lines on which action is urgently required, having seen some of the difficulties and obstacles in the way, and having reviewed the suggestions which have been made in various quarters I think we are justified in saying that sufficient consideration has not yet been given by the Government to this widely important question, and that the existing state of things is so unsatisfactory that there ought to be no further delay in dealing with it in a comprehensive manner.

Dr. Barwise (Derbyshire) said there was only one point he wished to call attention to, which was the point made in the paper as to the Royal Commission on Sewage Disposal having made a recommendation that Joint Rivers Boards should form supervising authorities over the water supplies within these watersheds. He happened to be Medical Officer of Health for Derbyshire, which was one of the authorities having the right to demand water under the Derwent Valley Water Act from the Derwent Valley Water Board, and he wished to emphasize the point that while the interests of Rivers Boards as sewage purification authorities were within a watershed, the interests of water authorities are never or very rarely within one particular watershed, so that the suggestion was an absolutely impracticable one. If the suggestion had been put into force the Derwent Valley Water Board would have been the Water Board for the Derwent Valley watershed. As it was, Sheffield under this scheme had some of the water, and if the suggestion were put into effect Birmingham would be taking water from a watershed under the supervision of some Welsh County Council. He only got up to emphasize the point which Dr. Kaye made when he said that if a particular Rivers Board was so comprehensive as to take

in the area represented by the present Water Board, then its territory would embrace all the Midlands, and any establishment which could deal in detail with the sewage problems of so vast and important an area would be incapable of supervising also the equally if not more important questions of water supply. It was an utterly ridiculous suggestion by the Rivers Commissioners that Rivers Boards should also be the supervising authorities over water supplies; it was an absolutely impracticable suggestion.

LIEUT.-COL. A. M. DAVIES (London) said he would like to make an observation in support of one paragraph in Dr. Kaye's paper, in which he thought supervising authorities, amongst other things, were required to establish and carry on a regular system of comparative examination—physical, chemical, and bacteriological—of all the public water supplies in their area, and thus gradually build up standards for each supply. Dr. Kaye pointed out that experience has shown over and over again that the significance of analytical data is relative and not absolute; that was to say, the early detection of slight mischief could best be made by comparison with previous regular records of the same supply. He spoke as one who had had some experience in the examination of water supplies, both bacteriologically and chemically, for many years past, and everyone who had done that work was aware that there was no absolute standard to be laid down, but that the great necessity was for standards to be arrived at gradually and by long-continued observations applicable to each individual supply or each class of supply. It was a widely prevalent idea that the bacteria in a water supply should not exceed 100 per cubic centimetre; and that if it contained less than 100 it was a safe supply. That had come about because Koch laid it down that a particular supply might be considered suitable if it did not contain more. As a general rule it was, of course, quite absurd. The only way really to arrive at a sound knowledge of the natural, or normal, *flora* (so to say) of the water supplies of a district was to carry out such a systematic and long-continued series of observations, as proposed by Dr. Kaye. In this way departures from the normal would be at once recognised, warning would be given, and very likely epidemics of water-borne disease averted.

THE CHAIRMAN (Prof. H. Robinson) moved: "That this meeting is of opinion that the whole question of water supplies demands investigation by a Royal Commission appointed specially to deal with that subject, and that representations be made to the Local Government Board accordingly." The resolution was what he suggested in his opening address. He would, however, amend the resolution and move: "That this meeting is of opinion that the whole question of water supplies demands investigation by a Royal Commission appointed specially to deal with that subject, and that representations be made to the Government accordingly."

The resolution was put to the meeting and carried.

T. READER SMITH (Kettering) also took part in the discussion.

DOMESTIC SANITARY ENGINEERING IN THE WEST OF SCOTLAND.

By GILBERT THOMSON, M.A., Assoc.M.Inst.C.E.,
Lecturer on Sanitary Engineering, Glasgow and West of Scotland Technical College.

(MEMBER.)

WHEN, in 1883, The Sanitary Institute last held its Congress in Glasgow, I had the honour of reading a paper entitled "Notes on House Sanitation in and around Glasgow." This was largely a record of observations made in my then position of Resident Engineer to the Association which is now known as the West of Scotland Sanitary Association, and while it was a very crude production, the facts therein given may be noted as a starting point.

Testing had come into prominence, and the various smell tests were on the point of being superseded by what has since become so widely known as the smoke test. Water testing was scarcely used, and indeed the ordinary methods of construction were so poor that very trifling tests brought much bad work to light. Even in towns cesspools were occasionally found, and drain traps were mostly of an antiquated form, Mr. Buchan's famous ventilating trap being then almost new. Disconnection, which has since become a watchword, was then in its early stages, and was strongly pressed by the eminent pioneers, and by those who, like myself, were working under their guidance. The pan closet was still in common use, and everything was enclosed in more or less elaborate woodwork. As regards sanitary or insanitary construction, every man was a law unto himself.

The change in this last respect is the chief cause of the improvement which has come about. While other causes have been operative, our present standard of work is chiefly due to the exercise by the sanitary authorities of compulsory powers. Opposed by powerful interests, and watched narrowly by keen critics, their work has been done with tact and skill, both in the detection and cure of existing insanitary conditions, and in the prevention of new ones. The latter, carried out by means of building regulations, is perhaps the most important work at present being done in this department of sanitation.

But some other influences in addition to official pressure deserve mention. Closely connected with it is the training of officials; and the work of examining and certifying sanitary knowledge, which in England is so efficiently carried out by The Sanitary Institute, is no less thoroughly done here by the Incorporated Sanitary Association of Scotland. This body has set a standard not lower than that of The Sanitary Institute, and is backed up by the enlightened action of many authorities, who require that their officials should hold its certificate. The education of the plumber is another important factor, and I may be permitted to refer also to another branch of the work done by the Technical College, where within the last dozen years I have had enrolled in my own classes on sanitary engineering considerably over 1,000 students, belonging to every class of sanitary workers. In addition to the direct effect, these various causes have exercised an indirect influence which is simply incalculable.

Our present position might be briefly described by saying that the standard arrangement of to-day is in its essentials very similar to the most advanced work of twenty-one years ago; that a first-class system of house drainage (there are a great many others) is now made of iron almost throughout; that the old notion of substantial and comfortable-looking woodwork has given place to the new one of impervious and non-absorbent construction; and that everything must now be done to the satisfaction of the sanitary inspector. In every new house, be it mansion, cottage, or tenement, and in every old one where suspicious circumstances have occurred, the drainage system is, as a matter of course, tested by smoke by the Sanitary Department.

Having thus reviewed our progress up to date, the question which naturally arises is whether our present methods are the best for securing good results now, and satisfactory progress in the future. My opinion is that they are not.

Our present standards of design, construction, and testing, for the great majority of houses, are simply those of the various building regulations. These regulations may be said generally to date ten or a dozen years back, or at least to represent pretty much the practice of that time. Internal evidence suggests that their framers tried to ensure sound work and hoped they would get it, but, after all, had considerable doubts about it. At that time, probably, the doubts were fully justified. But our tradesmen have risen to the occasion, and we now find no difficulty in getting work far better than could then be generally anticipated. On the other hand, the ordinary run of work can only just pass muster, and this not because of any great economy thereby effected, but because our regulations and methods of inspection do not give any inducement to do better.

I am satisfied that it would be possible to bring all work up to the standard which is now regularly attained in high-class work.

Not only would this be possible, but it would be a measure of economy. Our predecessors, in their well-founded suspicion about the work of their day, devised the plan of various lines of defence; so that if one failed there was another to help. The house drain was to be protected from the sewer, the waste-pipe was to be protected from the soil-pipe, and so forth, with the result that primitive simplicity was replaced by great complication. Numerous pipes were provided, each carefully "disconnected" from its neighbours, but making a big aggregate of dirty piping, accompanied by the accumulation of dirty water in the traps. For the same reason, drains, soil-pipes, and waste-pipes must all be outside the walls, so that if leakage occurs the harm done would be less. On the assumption that tightness cannot be secured, all these precautions, elaborate and costly though they may be, are perfectly sound. But is it necessary to accept that assumption?

It is said that the surest way to make a man dishonest is to suspect him of being so. Similarly, if in our building regulations we assume that we will not get sound workmanship, we have a good chance of seeing our suspicion justified. Our various lines of defence are practically an intimation that we expect weakness in each.

Suppose, on the other hand, we assume that everything will be tight. It would not then matter whether a drain passed round a house or through it, whether a soil-pipe was inside or outside the wall, nor whether a bath-pipe was disconnected. We should get rid of the grotesque notion that two classes of sewage, having their origin in the same apartment and their termination in the same drain, must travel by different routes. This of itself would fully justify what I have said as to economy.

It is obvious that any such change depends on the possibility of ensuring tightness. If this is unattainable, we must stick to our various lines of defence, with all their drawbacks, sanitary, financial, and æsthetic. I therefore go on to say, that tightness, for all practical purposes, can be secured by the simple means of effective testing. Others, as well as myself, insist on attaining it, and I can see no good reason why it should not be attained in all work under official supervision.

It need hardly be said that this assumes a surer means of proving tightness than the smoke test, which is now quite out of date except for exploratory purposes. Water, in some respects very suitable, has the disadvantage of great weight, which implies difficulty in application, irregularity of pressure, and risk of damage. The application of the water test to the drains, and the smoke test to the vertical pipes, is open

to the obvious objection that, as the strength of a chain is that of its weakest link, so the efficiency of a test is that of its least efficient part. But in the air test there is a simple and convenient means whereby it can be proved in a few minutes whether or not a drainage system is tight, and this test I expect will ultimately be adopted as a standard. Speaking from experience, I would say that it is on the whole rather more efficient than water, and of course very much more convenient. The smoke test may be used to locate the defects proved by other means to exist, although it is worthless as a proof of tightness.

What is required for future progress is the universal application of a really searching test. This will produce a standard of construction all round equal to what is now only attained in special cases. This will justify much greater simplicity.

Would the resulting house not be safer than one encircled by a drain, decorated with a forest of outside pipes, and freely sprinkled with traps—none of the pipes having been tested by anything more severe than smoke, and some, "because they only carry clean water" (which means the discharges from baths, sinks, and the like) never tested at all?

The severe test might be opposed for fear of extra expense, but such objectors might be disarmed by making the change a permissive one. If anyone wishes to build under the present regulations let him do so. But if he is prepared to submit his sanitary system to a searching test, give him in return practical freedom from restriction as to the positions of his various pipes, and let him, if he chooses, abandon disconnection. This would involve no possible hardship, and I am satisfied that before long the latter alternative would be universally adopted, and the inferior class of work would be killed out. In the meantime houses are going up in all directions, and are being passed by the authorities, with sanitary arrangements which any other specialist, would be bound to condemn.

It is, I think, fair to ask in conclusion, whether our progress during the last ten years has been so slight that the practice of the earlier date forms a proper standard for to-day? If not, then our building regulations should be revised. We often hear about the judicious use of the scrap heap. In the matter of these regulations a similar use might be made of the melting pot.

MR. T. R. SMITH (Kettering) remarked that it would be interesting to know how, when the air test was applied, the particular point of defect could be found out. In the smoke test, although the pressure might not be so high, they could see where it came from. He was not particularly acquainted with the air test, and he thought the water test was the better one.

Mr. A. G. Wallis (Glasgow) said he understood that Mr. Thomson wanted to do away to a large extent with the separate system of drainage and have one common pipe. He was largely in sympathy with that view himself, and thought it was one which should be adopted. But Mr. Thomson did not touch upon the main difficulty. When work was thoroughly well done in the first instance, would it continue good? His experience had shown him that although he had the work done in the best possible manner—and he subjected it in the first instance to the water, smoke, and air tests—yet in a few years' time the action of the hot water by the expansion and contraction would destroy the lead joints. He had never found a lead joint give way under the action of cold water only. Where hot and cold water ran alternately it frequently occurred. He knew in his own practice that it did, and having one pipe for the two classes of sewage certainly did increase the risk, although the work might be of high-class character. He agreed with Mr. Thomson as to what he said about the local by-laws. He did not know of late years what the by-laws in England were, but their by-laws in Scotland were very hard and fast, and insisted on a separate system throughout the whole building. In many cases it was a perfectly ridiculous thing from all points of view.

Mr. Gilbert Thomson (Glasgow), in reply, said that the methods of air testing were several, but the principle was the same in each case. The pipes were closed up, and by some means, such as an air-pump, either a low or a severe internal pressure of air was produced: this was watched by the gauge, which, as he used it, was an ordinary U tube, or "manometer." The operation was simplicity itself, and in his own practice he was in the habit of insisting that the pressure must be retained. He did apply the test to earthenware pipes, but he did not find them stand it as a rule, and for that reason among others he had given up the use of such pipes. The air test did not localise the point of defect, but the object of the local authorities or of engineers was to see whether or not the work was satisfactory. If the work was satisfactory, then it should stand the test. If not, then it was for the man who had done the work to find out the defect. The remark was made that with air one got a smaller pressure than with water, and that was assumed to be a disadvantage, but his experience did not show that it was so. An air-pressure equal to four or five feet of water was sufficient for any purpose, and it was often very useful to apply a much lower, but uniform, pressure. Mr. Wallis had called attention to what was undoubtedly a difficult point, but his own experience had been that if the system was thoroughly tight to begin with it would, as a rule, remain practically tight for an indefinite length of time. He felt that it was an absurdity to have a double system of drainage for no other reason than to conduct two classes of water into the same sewer, frequently from the same apartment.

Mr. F. Buckley (Dublin) and the President, Prof. Robinson, also took part in the discussion.

THE DRAINAGE OF A HOUSE.

By SAMUEL SMITH.

ABSTRACT.

IN this paper the writer dealt with the question of what materials were most suitable for underground drainage of a house, and discussed the relative merits of cast-iron and earthenware pipes.

Cast-iron pipes are used because they are impervious to moisture, and as they are supplied in longer lengths, thereby affording a smoother or more direct run, they can be laid at a lesser gradient than earthenware pipes. Do they fulfil these conditions, and for how long?

When cast-iron pipes are first laid they are air and watertight, and if the pipes are well jointed the sewage matter flows along smoothly and without much friction. But corrosion soon sets in, and becomes an important factor in the lifetime and efficiency of a pipe. To counteract this several expedients have been adopted, of which the best known is Dr. Angus Smith's solution; then there is the Bower Barff process of forming a magnetic oxide of iron on the surface of the pipe; and lastly by lining the pipe with what is termed a *glass* enamel.

A short time ago, the writer, in trying to find out what pipes would be the most suitable for a particular purpose, got the various preservatives on cast-iron pipes tested with a weak solution of sulphuric acid, and the following are the results:—

A one per cent. solution of acid completely destroyed the glass-enamelled surface within twenty-four hours.

A one-half per cent. solution of acid destroyed the magnetic oxide of the Bower Barff process and attacked the metal of the pipe within the same time.

A piece of pipe coated with Dr. Smith's solution was then tested in a one-half per cent. solution of acid, and at the end of twenty-four hours the skin was peeling off, leaving the pipe exposed to the action of the acid.

A piece of salt-glazed fireclay pipe was immersed in a five per cent. solution of acid without being in the slightest degree affected.

Tests were then made to find what pressure a drain-pipe was required to stand, also what pressure fireclay pipes would stand.

An ordinary washdown closet was tested, and the pressure found necessary to break a water seal two inches deep was ·120 lbs. per square inch.

A first quality fireclay pipe was tested by pneumatic pressure, and was found to be airtight at a pressure of 3·3 lbs. per square inch, a sufficient margin for all practical purposes. At the same time tests on fireclay pipes were made by hydraulic pressure, and they were found to resist a pressure of 250 lbs. per square inch without showing signs of fracture.

From the foregoing tests the writer had no hesitation in recommending that fireclay or earthenware pipes of good quality be used in preference to cast-iron pipes for underground drainage of a house.

[*For Discussion on this Paper, see page 489.*]

A FEW COMMON DEFECTS IN HOUSE DRAINS.

By J. W. PEARSON, C.E.
(Member.)

ABSTRACT.

THE defects dealt with in this paper are chiefly those arising from the adoption of manholes with open channels, and the use of earthenware pipes.

The best manholes of this description cannot, without elaborate precautions and great expense, be made to remain air-tight, and in any case their walls, bottoms, and channels become foul; they interfere with the effective ventilation of any system of drains upon which they are used; when deep, they are huge receptacles for foul air which is not removed by the ordinary drain ventilators; they are often the cause of stoppages; and where metal access covers are used at all these are often so fixed, or in such a condition through neglect, as to form a ready outlet for the foul air contained. Although they may look very well and very convincing when new they never satisfactorily stand the test of time. The advantage to be derived from a perfect drain is at once annulled by the existence of a

manhole which in a short time becomes defective and allows foul air to escape—perhaps under a window or floor ventilator, or, it may be, direct into the house itself.

By using closed access bends or junction pieces instead of open channel inverts in all manholes not only is the volume of foul air greatly reduced but it is confined to the pipes, and the manholes become what they really ought to be, viz.: a means of access to, but not an actual part of, the drains; and this without adding to their cost.

Earthenware pipes which are wholly unfit for the purpose are often used, but even when they are, of their kind, satisfactory, many defects crop up in laying them, any ordinary labourer being considered fully qualified to carry out this part of the work. They are also liable to injury when filling in or beating down the trenches, and any slight settlement of a wall or building is sufficient to break the pipes or the joints, and even the natural consolidation of the trenches may do so. The great number of the joints adds to this risk, and it is seldom that one tests an earthenware system of house drains that has been down for a few years without revealing defects more or less serious.

By the adoption of iron piping the majority of the defects common to earthenware become at least very improbable, but where the drains are of iron, all connected traps, etc., should be of iron also; a connection between an earthenware gully and an iron pipe is seldom a satisfactory one.

Glass enamel, though providing a very smooth interior surface to an iron pipe, is not always a safe preservative, as it is not proof against the action of acids, and where these are likely to be present in the sewage it should be avoided. Iron pipes should, however, always be treated with Smith's solution.

In several towns earthenware drains are not now allowed to be laid under any building, but if this were carried further, and neither open channel manholes nor drains of other than iron piping permitted within a certain defined distance of any house wall, most of the defects now met with would soon become things of the past.

[*This Discussion applies also to the Paper by* MR. SAMUEL SMITH.]

DR. H. SCURFIELD (Sheffield) said that if a second test were applied to an earthenware drain a permanent result would be obtained. The second test was put down in the specification for work to be done for the Manchester Corporation, and on the strength of that the method was adopted at Sunderland. The result of applying the water test both when the drains

were bare and all the joints exposed and when the ground had been filled in was that they got in most cases a permanent result. He had seen the test applied to earthenware drains several years after they had been laid down, and they had stood the test. By the second test they discovered if the trench had been carefully laid and if there had been any subsidence due to bad filling in, and also they found if the pipes were resting on their sockets. They also found whether the cement used was bad cement, or what was called hot cement, because if the cement was not properly air slaked, even although a perfectly good water test was obtained the first time, yet if it was repeated some weeks afterwards they would find the drain did not stand it owing to the sockets being cracked.

Mr. W. Kaye Parry (Dublin) remarked that during the last 20 years he had had a good deal of experience in regard to the laying of fireclay pipes with cement joints and could confirm absolutely the statement made by the last speaker. If they repeated the water test after the work was finished and no disturbance took place afterwards it was not only possible, but perfectly easy to so construct a fireclay drain which would remain perfectly watertight. He could point to many he had to do with 20 years ago which still remained tight, and a great many more which were laid ten, twelve, and fifteen years ago were still perfectly tight. The real trouble had been the one the last speaker had touched upon, viz., the splitting of the sockets owing to the use of hot cement. If drains properly stood the water test and no one interfered afterwards with them, his experience was that they stood right well.

Mr. A. Saxon Snell (London) observed that one way out of the difficulty was to require that a better class of labour should be employed, When an iron pipe was laid the joint was made by a plumber, a skilled man, but it was rarely that a builder employed anyone but a labourer to lay earthenware pipes. He thought they found most difficulties arise from that cause. Unskilled workmen were liable to use the cement for joints too hot, and they did not make them properly underneath. Another difficulty in the way of laying earthenware drains was the question of foundation. If they had a bad foundation it stood to reason they could use nothing but iron pipes with safety.

Mr. Henry Silcock (Mansfield) said he had an experience of iron pipes laid under the supervision of eminent engineers. They were laid to a rigid specification and the pipes were made by a good firm, and they had been completely eaten away within seven years.

The President (Prof. H. Robinson) asked what the water was which passed through them.

Mr. Silcock said they were eaten away from the outside, not from the inside.

The President said he could give an illustration of that too. A water

company had one of their largest mains, which had only been laid two years, leak. They found it laid in a clay subsoil, which had the effect of corroding the main. The main was laid again, but instead of laying it in clay, a certain amount of gravel was allowed to come into contact with the pipe. It was very important that the point should be brought out that it was the exterior of the pipe which was affected, the clay in that part acting on the iron.

DR. S. BARWISE (Derbyshire) said he thought the meeting was greatly indebted to Mr. Silcock for drawing attention to this point. Wherever there were pyrites in the soil it was absolutely dangerous to put in iron pipes. He knew not one instance, but several instances, where the pipes in less than ten years had got so corroded from the outside as to render them no longer water-tight. If this happened to a water pipe there was no reason why it should not happen to a pipe conveying sewage.

MR. S. SMITH (Glasgow), in reply, said that with regard to glass enamel, an agent for a manufacturer said he could not recommend it to be used, as in a cistern it became soft in two or three years. His contention was that a drain should be laid to take any kind of sewage and not only domestic sewage. If a man wanted to make any chemical experiment his drains should be able to take away the chemicals. Mr. Wallis had spoken of the expansion of lead joints, but he could assure Mr. Wallis that if he used earthenware pipes with cement joints he would have no reason to fear that.

MR. A. G. WALLIS, replying on behalf of Mr. Pearson, was of opinion that the second test was a good point, and he believed that Mr. Pearson used it. Mr. Pearson had something to say about hot cement in his paper. From the discussion it appeared that the only objection to cast-iron pipes was that they corroded outside. If only they took the trouble to put gravel round them they would be safe from corrosion. Glasgow was hard, solid clay, and it had no effect on cast-iron pipes. He had seen cast-iron pipes taken out after thirty years of use and found absolutely clean inside and out, and he knew two cases where cast-iron drains thirty years old had been re-adapted for modern purposes and were still in use. He agreed with Mr. Snell about the class of labour employed, and was glad to say in Glasgow the work was mostly intrusted to plumbers.

SANITARY FITTINGS.

By JOHN SHANKS.

(MEMBER.)

ABSTRACT.

THE following general laws should always be conformed to:—

1. The material used should be impervious, and, wherever possible, pipes should be left uncovered.

2. The general construction should be such that the accumulation of dirt can everywhere be easily prevented.

3. The supply arrangements (taps, etc.) should be such as to do their work as quickly as possible.

4. Bath and lavatory discharge and overflow pipes should be large enough to carry off the water with all supply pipes running full bore. Overflow pipes should be accessible, so that they can be taken out for cleaning.

Let me now take various appliances in detail.

Baths.—These, for public or for the best private work, should be of enamelled fire clay; but for general use, the material most to be recommended is cast iron porcelain-enamelled, *i.e.*, with the inside coated with white porcelain enamel which is practically incorporated with the iron by fusion in a muffle furnace.

Bath-rooms should be well lighted and ventilated; and they should also be properly heated by means either of radiators or of hot-water towel drying rails.

Closets.—Every closet should have floor and walls alike of impervious material. Closet traps should be separately ventilated.

Storage Tanks and Flushing Apparatus.—For perfect efficiency all houses ought to have storage tanks to furnish a supply for every purpose except drinking—drinking-water should always be taken direct from the main.

Closets may be flushed in three different ways:—(1) By what is known as a regulating supply valve, fixed over, or at the side of the water-closet, and fed from the storage tank referred to. Regulating valves of good

construction are noiseless, and with a good and ample water-supply very suitable and convenient. (2) From a cistern four to six feet above the closet. (3) From a cistern immediately above and behind the closet.

Cisterns placed immediately above and behind the pan, though at first looked on with considerable disfavour, have proved very successful. A regulating stop-tap renders them almost noiseless, the larger inlet more than compensates for the lack of height pressure, and the greater quantity of water washes the basin, clears the trap, and flushes the drain in a perfectly satisfactory manner.

Sinks.—Sinks are, of all our sanitary appliances, those that probably receive least care and attention.

These appliances should be made of strong fireclay, white glazed all over, with round edges, and with no woodwork settings or casings of any description whatever. A loose teak-wood grating may be placed in the bottom to prevent the breaking of crockery, or damage to the enamel from saucepans, etc.; but even here a wire cage is perhaps better. The large drain boards at the sides should be covered with tinned or nickeled copper. Sink and boards should be supported on cantilever brackets. The trap, discharging through the wall so as to leave the floor quite clear, should be of glass-enamelled cast iron, as lead is much more liable to injury from external violence. The waste and overflow pipes should be large. All angles, crevices, and dark corners should be scrupulously avoided.

THE IMPORTANCE OF UNIFORM DISTRIBUTION OF SEWAGE ON FILTERS.

By J. E. WILLCOX, A.M.Inst.C.E.
(Fellow),

And GEO. REID, M.D., D.P.H.
(Fellow.)

Mr. J. Edward Willcox.

IT is now generally conceded by all who are engaged on practical work in connection with the complex problem of sewage disposal, that among the many factors which enter into the question, that of the distribution of sewage on filters is one of the most important, and there is no question that a large number of failures to obtain satisfactory results are due almost entirely to the absence of proper means of distribution.

In order to ensure efficient distribution it is necessary that the liquid should be discharged over every portion of the filter in uniform quantities and at equal intervals of time, and the distributor should be so designed that these conditions may be under complete control and capable of variation.

With these conditions fulfilled, and provided the filters are properly designed and the filtering media of suitable character, size, and depth, it is found, unless excessive quantities of sewage are discharged on to the filters, that an ample supply of air will be drawn into the filters by natural means, even when they are being worked continuously by day and night for long periods, and that good results can consequently be obtained without any mechanical means of ventilation in order to increase the air supply.

It will be understood that with perfect control of distribution, both as to time and volume, the best depth for a filter dealing with any given sewage can readily be determined, though this knowledge is of little avail under the present regulations of the Local Government Board, a basis of

168 gallons per yard being adopted by the Board, whether for percolating filters or contact beds, and regardless of varying conditions; so that even if it were shown that by means of uniform distribution good results could be obtained from a shallow filter, it would be necessary to increase the area in order to comply with these requirements, and thus no saving would be effected.

During the last few years many new types of rotary distributors have been brought out, endeavouring to comply with the conditions before described. Many of them, working automatically and at little cost, have achieved results which, for practical purposes, are fairly satisfactory, but few, if any of them, are able to utilise to the best advantage the whole of the filtering area, owing to difficulties which arise in proportioning the size and spacing of the perforations in the revolving distributing pipes or troughs used for circular filters, the holes towards the centre of the bed being usually so small as to be readily stopped up, or so unequally spaced as to lose the advantage of fine distribution over the whole area, added to which the time intervals are influenced by wind, corrosion, and other causes.

Owing to these practical difficulties it is found almost impossible to ensure perfectly uniform distribution without adopting power-driven distributors, but with these any desired result as to rate of flow, duration or rest, can be obtained, together with absolute uniformity of distribution.

As the author believes that the experiments recently undertaken by his firm in connection with Dr. George Reid, the County Medical Officer of Health for Staffordshire, are the first in which power-driven distributors have been used, it was thought that a description of these might be of sufficient interest to the members of The Sanitary Institute to justify a paper on the subject.

The experiments were carried out at Hanley, in Staffordshire, a county borough having a population of 62,000; and were on a large scale, dealing with half-a-million gallons per day. The results obtained are given in a paper by Dr. George Reid, who undertook all the analytical work in connection therewith.

The installation for the purpose of the experiments consisted of a small detritus chamber and an open septic tank of 500,000 gallons capacity, together with two large filters having a total area of half an acre.

An existing tank was utilised for the purpose of the experiments and altered so as to convert it into an open septic tank by means of weir inlets and deep scum boards in the usual way, the tank effluent being pumped continuously by day and night to the chamber feeding the filters.

In this chamber a weir for gauging, and valves for controlling, the flow to the filters were fixed, weirs being also provided in the effluent chambers for measuring the volume of the filtered effluent.

There were two filters, one circular and the other rectangular, each having an area of a quarter of an acre. The material used for filtering consisted of "saggars," a pottery refuse admirably adapted for the purpose, being clean, rough in surface, hard burnt, and not liable to disintegrate; it is also readily crushed to the proper size, the particles being more or less conical when broken up.

As we were desirous of obtaining information not only as to the best rate of flow on to the filters, and intervals of rest between each discharge, but also as to the most suitable size for filtering media, the beds were divided into sections, each being filled with different sized particles. A separate system of under-draining was provided so as to enable samples to be taken therefrom.

The circular filter was thus divided into four, and the rectangular into two sections, the size of particles from below upwards being as follows :—

Circular Filter.

Section I. 6″ = 2½″ to 1½″; 3″ = 1½″ to ½″; 3′ 9″ = $\frac{3}{16}$″ to ⅛″ particles.
Section II. 6″ = 2½″ to 1½″; 3″ = 1½″ to ½″; 3′ 9″ = ½″ to ⅛″ particles.
Section III. 9″ = 2½″ to 1½″; 3′ 9″ = ½″ to ¼″ particles.
Section IV. 9″ = 2½″ to 1½″; 3′ 9″ = 1½″ to ½″ particles.

Rectangular Filter.

Section I. 1′ = 1½″ to ½″; 3′ 6″ = $\frac{3}{16}$″ to ⅛″ particles.
Section II. 1′ = 1½ to ½″; 3′ 6″ = ½″ to ⅛″ particles.

It will be noticed that Sections I. and II. in both cases corresponded as regards size of particles in the body of the filter. The object of this was to allow of a legitimate comparison being made between the results of two filters worked under identical conditions, and differing only in the mechanism for distributing the sewage.

The distributor used for the circular bed was designed by Mr. Scott Moncrieff, and consisted of two troughs 66 feet in length, carried by lattice girders and fed from a central pipe, the whole being rotated by means of a 6 h.p. oil engine travelling on an outside rail. The arrangement will readily be understood from the drawing.

On the main trough a number of slots are provided supplying the

Diagram showing Degree of Purification, as estimated by the reduction in Oxygen Absorbed and Organic Ammonia, and the amount of Nitric Nitrogen in the Effluents.

smaller feeding trough which is divided into nine sections, each slot being in the centre of the section it feeds, and of a size proportioned to the area to be covered working under a constant head of one inch of effluent. From each section the sewage is distributed over fixed weirs capable of being so adjusted that the quantity discharged on to the bed can be regulated to be proportionate to the area covered; ribs are provided on the outside of the feeding troughs for breaking up the stream of water flowing over the weirs, which they do most effectually. The distribution is quite satisfactory and under complete control, but the general arrangement is somewhat cumbersome, the whole of the weight (12 tons) is carried on one outside rail, so that strong expensive foundations are necessary; these objections could however be readily overcome.

For the rectangular filter a travelling distributor, designed by my firm, has been adopted, and as this type of distributor is new a short description may be of interest.

A steel trough carried on suitable supports is taken the full length over the centre of the filter, this trough being kept supplied with sewage by means of a floating valve, so that a constant head is always available.

The travelling distributor consists of a carriage with wheels running on rails fixed on each side of the central trough, and supporting a pipe in the form of a siphon, with trapped outlet, by means of which the sewage is drained over the side of the troughs into the distributing pipes; these are 64 feet in length, and are carried on two wheels running on the outside rail. Valves are provided to regulate the flow to the filters as well as air valves and means of charging the siphon with sewage.

For the purpose of the experiments the distribution is effected by means of a trough, with slots or notches on one side of the siphon, and on the other side by means of a pipe with nozzle, the latter arrangement being found to be the better of the two.

The apparatus travels backwards and forwards the whole length of the filter, and by means of a simple automatic valve arrangement each side is fed alternately to insure equal intervals of time between each discharge on to the bed.

The distributor is propelled by means of a wire rope running on revolving pulleys at the ends of the filter, these being driven by means of a small electric motor.

The general arrangement, which is quite simple, is shown upon the drawing, both the volume of sewage and the intervals of time being under complete control, and its efficiency may be judged from the excellent results obtained.

The power required for the quarter-acre filter is only 1·08 h.p., and the actual cost of driving the distributor, including labour, is 2s. 5d. per day of 24 hours, the quantity of sewage dealt with during that period being 250,000 gallons.

The experiments have been carried on continuously by night and day with occasional stoppages for slight repairs for a period of fifteen months; the volume of sewage dealt with was 100 gallons per super yard, which was gradually increased to 230 gallons, and it is intended to still further accelerate the flow. The intervals of time have been varied from four to seven minutes, the best results from a given volume being obtained with the longer interval.

The neighbourhood of the sewage works is thickly populated, but no nuisance has arisen from them. It should, however, be mentioned that the sewage is discharged only a few inches above the bed. No difficulty was experienced by reason of frosts during the cold weather last winter, including four nights when no less than 16 degrees of frost was registered.

The results of the experiments have been so satisfactory that the author's firm has been instructed to carry out a complete scheme for dealing with the sewage of the borough on the same lines, it being intended to adopt rectangular beds, and 18 power-driven travelling distributors, each controlling half an acre filter bed and capable of dealing with some 12 million gallons per day.

The whole of the work in connection with the construction of the experimental installation was carried out by the corporation without any contract, under the supervision of Mr. W. H. Makepeace, the Clerk of Works, who also had charge of the experiments.

The circular distributor was erected by Messrs. Manlove Alliott of Nottingham, and the rectangular one by Messrs. Thomas Piggott of Spring Hill, Birmingham.

Dr. Geo. Reid.

IT is now pretty generally admitted by those who have been actively at work in endeavouring to solve the sewage-disposal difficulty by artificial biological methods that filtration is to be preferred to contact as a means of effecting the final process of oxidation. Probably, also, most of you will agree that, had it not been for the mechanical difficulty involved in effecting the distribution of sewage uniformly over a large area

of filter, we should have heard nothing of the latter method, and thus what is only being achieved by engineers to-day would have been an accomplished fact years ago. I do not mean to say that the difficulty of distribution has yet been finally solved, but I think we are now sufficiently far on the way towards its solution to warrant a pretty confident opinion that there will be no turning back.

Having recently had an opportunity of putting to the test on a large scale what could be effected by the filtration-process combined with perfect and uniform distribution, under absolute control, by means of the appliances described by Mr. Willcox, it occurred to me that the results had proved sufficiently striking to warrant my bringing them to the notice of this meeting.

Possibly some of those who are present may have seen my report on the working of the plant, which was published only a few weeks ago, and which, of course, enters much more fully into detail than it is possible for me to do in a short paper. At the same time, by very shortly bringing the salient points of that report to your notice to-day, I am hopeful that a discussion will follow which will prove both interesting and instructive.

In advising the Hanley Corporation to construct the experimental works we had three chief objects in view, namely, to determine (1) whether the sewage in question could be disposed of by treatment in resolving tanks, followed by single filtration: (2) the area and depth of filter necessary in view of the highly efficient means of distribution provided: and (3) the size of filter particles which would give the best results.

We knew from previous experience that double filtration, after treatment in a resolving tank, would produce a satisfactory effluent, and we also had a pretty firm conviction that, with perfect distribution, single filtration through a depth of filter of about 4 ft. 6 in. would answer the purpose.

That this conviction was justified has been demonstrated by the results of about 18 months' working of the plant.

The question of securing efficient distribution was not an easy one. The method of distribution by sprays, even had such a method complied with the high standard desired, was out of the question, because of the nuisance which would undoubtedly have been experienced by adjoining residents from the fine spraying of a septic effluent over a large area. The same objection applies in the case of the costly Stoddart distributor, even had it fulfilled the other requirements, which, in my opinion, it does not—neither did the automatic revolving distributors, useful though some of them are under certain circumstances, appear to meet the case fully.

Having talked the matter over with Mr. Scott-Moncrieff, who has done so much excellent work in advancing both the science and technique of sewage disposal, he designed the apparatus described by Mr. Willcox, and, later on, Mr. Willcox brought out his own distributor.

As to the comparative cost of these two distributors, either as regards capital cost, or working expenses, I have nothing to say—that being an engineering question—but I may state that both complied with the stringent conditions laid down in the first instance, and (I believe for the first time in the history of sewage disposal by artificial filtration) the feeding of the filters has been conducted by means which are completely under control, so far as the vital requirements of the process are concerned.

As regards the rate of flow, in the case of the circular filter, a constant and regular flow of 200 gallons per superficial yard was maintained. In the case of the rectangular filter, however, owing to a defect in the distributor, which I understand could easily be avoided in reproducing the apparatus, the delivery did not always amount to 200 gallons per yard, but varied from 130 to 200 gallons, the mean being 162 gallons.

A rate of flow of 200 gallons per yard per 24 hours was decided upon, because experience had shown in the case of other works that such a rate could not be exceeded without greatly reducing the degree of purification obtained, and this rate was maintained throughout (in the case of the circular filter) to allow of a sufficient number of records, extending over a sufficient period, being obtained to warrant a reliable conclusion being arrived at.

The rate of travel of the distributors was so adjusted that each yard of filter received its quantum of sewage at seven minutes' intervals—the time recommended by Mr. Scott-Moncrieff as the outcome of his experience in the working of biological filters designed by him some years ago.

In future it might be well to test the power of the filters for dealing with an increased volume per 24 hours, and the distributors might be worked at different rates of travel, as it does not follow that a rate of 200 gallons per yard may not be exceeded with impunity in the case of filters worked under such perfect conditions as regards distribution, neither is it certain that the most effective inter-delivery period is seven minutes.

That the rate of filtration in all probability can be increased without material injury may be inferred from the fact that the results from the circular filter, working at a rate of flow 23 per cent. in excess of the rate in the case of the rectangular filter, were practically identical with those from the latter.

It would also be interesting and instructive to ascertain whether artificial ventilation of the filters, by means of an extracting fan placed in the effluent channel, would increase their efficiency to an extent which would warrant the adoption of such a means of assisting the nitrifying process. I understand that this experiment, in the case of the circular filter at any rate, might readily be tried.

With reference to the results obtained, the following table, showing the mean figures of analyses of the samples, speaks for itself :—

Analyses of Sewage and Effluents.
Mean Results in Parts per 100,000.

Sample.		Sizes of Particles in Body of Filter.	No. of Samples.	Parts per 100 000.							
				Solids.			Chlorine.	Free Ammonia.	Organic Ammonia.	Oxygen absorbed in four hours at 80 F°.	Nitric Nitrogen.
				In Solution	In Suspension.	Total.					
Sewage.....		...	8	125·4	62.9	188·3	8·9	2·109	0·765	3·854	0·00
Septic Tank ...		...	7	105·3	4·4	109·7	8·7	1·820	0·270	1·725	0·00
Rectangular	Sec. I....	$\frac{3}{16}$″ to $\frac{1}{8}$″	14	112·0	0·4	112·4	8·5	0·081	0·029	0·273	1·75
Rectangular	„ II....	$\frac{1}{2}$″ „ $\frac{1}{8}$″	14	111·9	0·3	112·2	8·3	0·098	0·032	0·278	1·73
Circular	„ I....	$\frac{3}{16}$″ „ $\frac{1}{8}$″	13	112·1	0·2	112·3	8·4	0·096	0·025	0·242	1·66
Circular	„ II....	$\frac{1}{2}$″ „ $\frac{1}{8}$″	13	112·9	1·4	114·3	8·3	0·036	0·029	0·259	1·53
Circular	„ III....	$\frac{1}{2}$″ „ $\frac{1}{4}$″	13	112·8	0·7	113·5	8·4	0·037	0·030	0·252	1·62
Circular	„ IV....	$1\frac{1}{2}$″ „ $\frac{1}{2}$″	13	113·1	1·7	114·8	8·3	0·119	0·046	0·327	1·62

As regards the quality of the sewage, the analytical records indicate that it is an ordinary domestic sewage not of a very strong character, the dilution being accounted for by the discharge into the sewers of a considerable volume of mine drainage water, as well as a certain amount of stream water from a small tributary stream, which, having received some sewage from Hanley and the adjoining borough of Burslem, communicates with the outfall sewers.

Shortly, the conclusion to be drawn from the figures is that in every case the degree of purification which has been effected is excellent. The good quality of the work done exceeds that of any plant of which I have had experience, neither do I know of any published records which approach those of Hanley as regards the degree of purification effected with an equal rate of flow.

From the above table of mean results, I have prepared the attached diagram which shows very clearly the percentage purification effected by the various sections of the filters, based upon the percentage reduction in the organic ammonia and oxygen absorbed figures and the actual degree of nitrification.

It will be seen that treatment in the septic tank effected a purification of 64 per cent. and 62 per cent. in the organic ammonia and oxygen absorbed figures respectively, while as regards the filter effluents these percentages varied from 94 per cent. and 91 per cent. in the case of the large grain section of the circular filter to 97 per cent. and 94 per cent. in the case of the finest grain section, the last-named figures being practically the same in the corresponding sections of both filters.

As regards the degree of nitrification effected, the results are practically the same in the case of all sections of both filters.

With reference to the routine working of the filters, I may mention that no trouble was experienced, with the exception of a temporary water-logging of the large-grain section of the circular filter (1½ in. to ½ in. particles), an occurrence which was corrected by a short period of rest. That this occurrence should have happened in the case of the large-grain section only, confirms the accuracy of the opinion I formed years ago, namely, that it is desirable to reduce the size of particles in such filters to the greatest extent compatible with thorough aeration.

I have endeavoured to condense my remarks as far as possible in order to economise time and allow of fuller discussion, and I will conclude merely by quoting the last paragraph from my report to my council on the working of the plant as follows:

I may state that the working of the preliminary plant has exceeded my highest expectations, and I am of opinion that the Hanley Corporation may with confidence proceed on similar lines in laying down a plant of sufficient capacity to deal with the whole of the sewage of the borough.

Dr. G. Fowler (Manchester) said he wanted to enter an emphatic protest against the statement, at the beginning of the paper, that "it was now generally admitted that filtration is to be preferred to contact." It seemed to him, in view of the fact that if it were calculated up it would be found more sewage had been purified by the so-called contact method in England than by any other method, that statement could hardly stand. He protested against sweeping and dogmatic statements of that kind as tending to do a great deal of injury to quiet and scientific development of sewage treatment. What they all wanted to get at was

the simplest and least costly methods for the various classes of sewage they had to deal with. He felt that those responsible for schemes must be guided by local conditions. Dr. Reid himself said he had nothing to say on the question of cost, as that was purely an engineering matter; but some of them were responsible for the question of cost, and they had to consider very carefully the pros and cons of each case. He noticed that the cost of running this distributor was fairly large. It amounted to about 10s. 6d. per million gallons, and if they could build contact beds at a low first cost and work them at about 3s. 6d. per million gallons, then it seemed to him that they could not say that under all circumstances filtration was to be preferred to contact.

Professor H. R. Kenwood (London) said that so far as the installation at Hanley was concerned there was no doubt that the results were very good. He had had the advantage of reading a full report of the experiments made, and was confident that the result had proved very satisfactory indeed. At the present stage, however, there was so very much to learn that they could not afford to generalize with reference to the treatment of sewage. What was a good method in one district was, in his experience, sometimes a bad one in another. As to the advantage of sprinklers, he did not doubt that, in well-selected cases, sprinklers were better than contact beds. In the same time they could deal with a larger amount of material, but whether sprinklers should be recommended or contact beds must depend upon a variety of local considerations and circumstances. The whole matter was wrapped up, in the first place, with the question of the degree of sedimental treatment of the solid matter in the sewage before the latter was applied to the beds. If they had not ample tankage accommodation and, therefore, were unable to give the material sufficient sojourn in the tank, or sufficient time for thorough chemical precipitation, the sprinkling of sewage on to one fine filter would be the wrong thing to do, and they would not get a satisfactory result. If they were dealing with purely domestic sewage of a rather weak order, where they had sufficient tankage provision to enable the solid matter to be dealt with efficiently, then he had no doubt the sprinkling bed was the thing to use. On the other hand he had known cases where, owing to insufficient tankage accommodation for a very foul sewage, the sprinkling apparatus had had to be discontinued, for the reason that the sewage was so odorous that the act of sprinkling gave rise to a local nuisance. The gases which had been given off had, in this particular sewage, created a nuisance which had made the area unnecessarily offensive, although the effluent had been satisfactory. They would all be heartily in agreement with Dr. Reid in his statement that some sewage could be dealt with quite efficiently by single filtration, whereas on the other hand other sewage required a double filtration. He himself was a great advocate of the provision of secondary filters. He felt that it was their only guarantee of ability to constantly produce a satisfactory effluent, and it shortened the period of treatment necessary to produce satisfactory results. There were

times when the primary filtration broke down unaccountably, and unless they had a large area of land, or a second row of filters, they had no guarantee that they were able to conform to the very high standards required by county authorities and by some of the water conservancy boards. He thought the amount of area at the disposal of the local authority was a matter which affected the question whether advice should be given for sprinklers or contact beds. If the area was limited they could get more work done by sprinkling than by contact. Personally he would be inclined, if a local authority had sufficient area for contact beds, and had a sewage of a strong nature, to advise contact, and he thought probably on the whole it would be cheaper; and although he was an advocate of purely biological purification, he recognised that there were many instances where chemical precipitation gave better results at a lower cost.

Dr. S. Barwise (Derbyshire) said he thought the statement made by Mr. Fowler that the contact system was cheaper would want a great deal of proving. In fact in his county they had had estimates which had been very carefully gone into as to the relative system of double contact and single filtration, because, after all, to compare results with single filtration they must have double contact. They had had these estimates prepared and they had been before a Parliamentary Committee, and the result was that on the score of economy alone in Derbyshire they had gone in for single filtration. In the first place it necessitated having a sufficient area of septic tank, which was one of the most expensive parts of the work, for it must be made watertight; but it saved a relatively large area of other watertight tanks, because contact beds had to be made watertight. On the score of economy alone, single filtration and a large area of septic tank was cheaper than double contact beds and a smaller area of septic tanks. The one point in favour of contact beds, in his opinion, was that the distribution over them did not make the amount of aërial disturbance which the spraying of sewage over the filter made. But the method of distributing sewage by means of such an arrangement as Mr. Willcox had shown made practically no smell whatever, and he thought that even with a septic tank which was odourous the sewage might be distributed over the filter bed without creating any nuisance. Where, however, the sewage contained brewery waste or there were sulphates in the drinking water of the district, and the septic tank effluent was a solution of sulphuretted hydrogen, a contact bed was necessary before the sewage was distributed over the filter, and they could get their results by having a comparatively small septic tank, a contact bed, and a percolating filter. What they were doing in Derbyshire, where they were paying for small schemes out of the current rates, was that they put heaps of ashes on the ground and distributed the sewage by means of revolving, perforated pipes. There was one first principle with regard to this which every one knew, which was that the area of the filter went up by increasing the diameter of the filter in geometrical progression, while the cost of distribution only went up in arithmetical progression. He would like to

corroborate what Dr. Reid said as to the advantage of the distributing arrangement for small works, which was shown at The Sanitary Institute Exhibition.

Mr. W. Allan Carter (Edinburgh) asked whether in the arrangement for distributing sewage which was shown by the authors of the paper, the reversing of the distributor when it came to the end of the bed was automatic, and also what amount of supervision was necessary for keeping it in satisfactory working order. Did it require a man to be in constant attendance on it, or could it be left by itself to go on from day to day working satisfactorily? Further, the question of 200 gallons per yard of filter was mentioned as the amount of sewage dealt with. Did that mean a superficial yard of filter, or was it 200 gallons per cubic yard of filtering material? As to the general discussion which had taken place, one point appeared to have been excluded by the speakers in connection with single or double contact, or single or double filtration, and that was as to what they found in so many cases, that both double contact and double filtration became impossible through the levels on which they were obliged to work. They often found that towns and villages were placed at such a low level relatively to the river into which they drained, that it was impossible to give either two contacts or two filtrations without going to the costly method of pumping from one to another; and therefore, when they came to consider the cost of carrying out works of this sort for a municipality, it was not always a question of the most perfect way of dealing with the sewage, but as to the cost involved in obtaining a second filtration or a second contact.

Mr. E. Halliwell (Preston) said one point in the paper was very interesting in that the table of analyses gave the amount of suspended matter in the septic tank effluent as only 4·4 per 100,000. In many towns in N.E. Lancashire the amount was very large, and the average of 4·4 as stated in the paper would be enlarged to approximately 15. This had a very important influence. When discharged on to the filter it would either be retained by the material of the bed or would be discharged with the effluent. He had seen a great many sprinkler filters in different towns, and in nearly all cases the amount of suspended matter carried away in the effluent was very large, and this suspended matter contained a large amount of organic matter. The further treatment which the effluent required would depend upon the nature of the stream, but as a rule further treatment was essential. He would like to ask the authors of the paper if they found the effluent coming away from their works contained much of this suspended matter, and whether it was found to be increased or decreased according to the time it took for the liquid to pass over a particular portion of the bed. It was necessary to point out also that the depth of these beds was only 4 ft. 6 in. There were many beds being constructed 8 ft. to 9 ft. deep, and if they choked these beds by retention of suspended matter, the want of aeration would sooner or later be shown by the only partial purification of the effluent.

Dr. Barwise asked if the effluent from the percolating filter under Dr. Reid's supervision contained suspended matter?

Mr. A. J. Martin (London) said he would like to join Dr. Fowler in the emphatic protest he had made against the habit, which had become common, of making sweeping general statements with regard to one method or the other being the only proper one to use. Dr. Barwise had stated that the septic tanks which he had used were the most expensive part of the purification works, but those who had the responsibility of estimating for such works would be only too thankful if they could lay down the filtration part of an installation for the same cost as the septic tanks. Another statement of Dr. Barwise was to the effect that double contact was necessary to produce the results obtainable by single filtration. In his own experience he had produced results by single contact which were sufficiently good for the generality of purposes, and he did not think it was necessary to have double contact in such a place as Barrhead. Coming back to the papers, there was one important point arising out of them, namely, the cost of the distributor. Dr. Reid had told them that that was an engineer's question, and he had nothing to say on it; but he noticed that, although it was an engineering question, Mr. Willcox did not deal with it beyond saying that he did not insist that this method of distribution was necessarily the proper one for a small place. In drawing attention to the cost of the distributor, he did not wish to be misunderstood. It might or might not be an expensive one; but even if it was, it did not follow that it was not economy to use it. He fully agreed with a statement made at a previous meeting as to the economy of using a costly but efficient distributor, and he was glad to see Mr. Willcox had produced one which seemed to give satisfactory results. Dr. Reid had referred to the desirability of dispensing, if possible, with independent motive power, and he would like to mention what he had been accustomed to do in his own practice with regard to distribution. So far as possible he had avoided the use of travelling distributors, whether longitudinally or rotary, and had used fixed pipes. At first sight it might seem that these would not cover the bed so efficiently as a travelling distributor; but he secured that object by varying the head on the orifices. He ponded the sewage, and released it at intervals in such a manner that the variations in the head on the orifices gave an absolutely even distribution over the surface of the bed. Dr. Barwise had also called attention to the necessity of a second line of defence, and he certainly approved of that. In view of the possibility of the liquid finding short cuts for itself through the filter, he always adopted the safeguard of providing a contact layer in the bottom of the bed, in which the liquid should be held for a short time in contact, in order to bring about those changes which required more time than was occupied in travelling from the top to the bottom.

Dr. Barwise (Derbyshire C. C.) asked if Mr. Martin could tell them whether

the effluent from any single contact bed he was aware of showed less than 0·1 per 100,000 of albuminoid ammonia.* If Mr. Martin made the statement that from single contact they could get a good result then they must have the figures.

Mr. J. E. Parker (Newcastle-on-Tyne) asked whether in Hanley there were two systems of drainage or only one. Was there one system for the rain-water and another for the sewage? In his experience the flow of the combined system of sewerage in wet weather largely exceeded six times the dry weather flow.

Mr. J. E. Willcox (Birmingham), in replying, said that the greater part of the district was separately treated. Mr. Martin raised an important point as to cost. His reason for omitting the cost of the circular filter was simply that the whole thing was experimental. The distributor was run by a 6-horse power oil engine, but in actual practice they found that $3\frac{1}{4}$-horse power would be sufficient. The result was that if they took the actual cost it would work out at an unfair figure, having regard to what really could be done, for he had no doubt that Mr. Scott-Moncrieff, in designing another distributor, would put in a less powerful engine, and so reduce the cost. Another thing was that the whole weight was carried on one outside rail. In another distributor they would put a centre to reduce the weight, and so work at less power and at less cost. The same remark applied to the rectangular filter. They utilised an old 6-horse power alternating current motor they had at the works, but if they had put down a new motor of the

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*An analysis made by Messrs. Tatlock and Thomson last April of the filtered effluent from the single-contact installation at Barrhead showed 0·052 parts of albuminoid ammonia per 100,000.

On page 131 of Dr. Barwise's book on "The Purification of Sewage," will be found his own analyses of effluents from the single-contact installation at Exeter, the filtered effluent from which yielded 0·09 parts. The Exeter sewage is described as a particularly weak one, but it will be noticed that the albuminoid ammonia yielded by the tank effluent is comparable with that at the majority of the trickling filter installations described in the same work, the average of which happens to coincide almost exactly with the albuminoid ammonia in the Barrhead tank effluent.

While thus acceding to Dr. Barwise's request for an instance of a single-contact effluent yielding less than 0·1 part per 100,000 of albuminoid ammonia, I need hardly say that I strongly deprecate the establishment of any such arbitrary standard.

I am at a loss to understand why he should have selected the albuminoid ammonia as the basis of comparison, seeing that on page 18 of his own book he lays stress on the quantity of nitrates present as being "the best test of the work done by the filters." Judged by this standard, the single-contact effluent from Exeter, in which he found two parts of nitrogen as nitrates, is greatly superior to the majority of the trickling-filter effluents which he cites. It is, in fact, excelled only by the effluent from the Ducat filter at Hendon, by two of the Chesterfield filtrates (the average of which, however, is below the Exeter figure), and by the *double*-percolation effluent from Darley Abbey.

If from the composition of the filtered effluent we turn to the purification effected, the evidence still fails to support the contention that double contact is required to produce the results obtainable by single filtration. The Barrhead analysis, to which I have already referred, shows that the single contact reduced the albuminoid ammonia by 84·7 per cent. and the oxygen absorbed by 78 per cent., the former figure being within 1·1 per cent. of the reduction quoted by Dr. Barwise as being effected by two successive percolations at Darley Abbey. (The oxygen absorption at Darley Abbey is not given.)—A. J. M.

continuous-current type they would have done better. Notwithstanding that, he did not himself consider that 10s. per million gallons a very excessive price, seeing that they got uniformity of distribution and absolute control, which they required for the purpose of that experiment. A question was asked as to whether, in the event of the distributor passing more slowly over the beds, the suspended matter came away. He replied "yes" to that. He had on several occasions had the distributors running very slowly, and if they ran slowly they found that in about ten minutes they got the suspended matter, but the whole object of those experiments was not to run at alternative speeds, but to run with absolute uniformity, both as to volume and as to time. Another speaker asked if there was an automatic reverse carrier. The answer was "yes." The question of cost also came in in connection with this, and with regard to what attention was required. He had a man looking after both Mr. Scott-Moncrieff's distributor and his own, who spent his spare time looking after other machinery, and it was difficult to say what the actual cost would be when a full installation was established. One or two hours a day were taken oiling and keeping the troughs clean, but of course in the initial stages it took longer, as certain experiments had to be made. When they got into working order one man could easily look after the two distributors and other machinery as well. The 200 gallons was per superficial yard. Their levels were such as to render double filtration quite possible, and in the big scheme for the whole of the borough of Hanley there were nine acres of filter beds for double filtration, which could be added to if necessary.

Dr. Reid (Staffordshire) also replied, and alluding to the remarks of Mr. Fowler, said that if he had a thorough conviction that one thing was better than another, then, no matter how extensively the other method might be in operation in the country, he should most positively express his opinion. Unless one stated one's opinion they would never get any advance at all. He purposely omitted the question of cost because he was not in a position to speak of it, but he did suggest that supposing a mechanical distributor did cost more money to provide and work, yet if it could be shown that by reason of more perfect methods of distribution they could save a large area of filter and a considerable depth of filter the cost became a secondary matter. It was all a question of whether they laid down more capital expenditure on their works or a little more capital expenditure in the way of improved distribution. Prof. Kenwood had said that what might be a good thing for one district might be a bad thing for another, and he suggested that it might be wrong to sprinkle the effluent, unless highly clarified, on a filter of $\frac{1}{8}$-inch particles. He did not mention the fact, but the size of particles which Hanley had determined to adopt, was that which would pass the $\frac{1}{2}$-inch gauge and be rejected by the $\frac{1}{4}$-inch gauge. They would notice that the results were not very much different in the various sections of filters, and it was much less costly, he believed, to construct a filter of the size selected than one of a smaller

size. He would call attention to one interesting fact in connection with the work of the filters. Reference had been made to the danger of applying an effluent with suspended matter on a small grain filter, but he suggested that it was more dangerous to apply that effluent on a large grain filter. If they applied any amount of suspended organic matter to a small grain filter it would not get into the interstices of the filter, and then they had a better chance of getting rid of it. He would like to refer to a circumstance which happened in connection with the actual working. Clogging only occurred on one occasion. They had four sections in the circular filter containing different-sized particles, and clogging occurred only in the one with the largest particles in it. Mr. Martin had told them of the method of distribution he adopted by means of nozzles, but such a method would have been impossible at Hanley, because instead of having one travelling line with a comparatively small area they would have had the whole area exposed, and the wind blowing over that area would cause a nuisance which would be intolerable. They felt that it was impossible, having regard to the close proximity of houses, to run such a risk. Mr. Halliwell asked where the suspended matter went to in the sprinkling filter. It went the same way as in a contact bed; it was oxidised. He had a filter at work at Burslem in which there was no septic action in the first instance. The crude sewage was put on the filter, and after four years' work the material of the filter was absolutely clear, notwithstanding the fact that there was no septic tank. The same with the filter at Hanley. If they dug down into the bed of the filter they found that after 6 or 9 inches there was no staining whatever of the particles. The suspended matter did not come away with the effluent, as the actual amount present in the various samples was only ·4, ·3, ·2, 1·4, ·7, and 1·7 parts per 100,000. He could not deal with Mr. Martin's point as to the effluent obtained from single contact as no figures had been put in, but he felt that Mr. Martin's other point as to holding up the sewage at the bottom of the filter was radically wrong, and he could not see the advantage to be gained by it.

PORTLAND CEMENT: THE NEED OF A STANDARD TEST.

By ERNEST R. MATTHEWS, C.E., F.G.S., F.R.S.E.
(Member.)

ABSTRACT.

THE author has endeavoured in this paper to show that the time has arrived when there should be a standard cement test which every cement manufactured or used in this country should pass.

He states that the use of Portland cement for constructional purposes is a modern thing dating back only to about the year 1825, and that there never was a time when cement was so extensively used as to-day, especially does this apply to its use in all sanitary engineering works, such as sewers and reservoirs, neither was there ever a time when there were so many cements in the market, good and inferior, as the present time. In order to keep out the latter and prevent so many failures, it is, he maintains, most necessary that all cement should pass a standard test; as it is, the matter rests entirely with the engineer or architect, and what one considers a fairly stringent cement test, another considers miserably weak: the specifications of some engineers and architects as to the quality and strength of cement are extremely weak, not only so, but in many specifications different clauses are altogether inconsistent and contradictory one with another, and so long as the manufacturer supplies his cement in accordance with the specification, he cares nothing further; with many manufacturers the weaker the specification the more satisfactory to them. If a standard cement test were in vogue, this use of inferior cement would be obviated.

The author finds that the annual production of Portland cement in this country is about 24 per cent., or nearly one-fourth of the world's total output. Germany, however, outstrips every other country in cement manufacture, both as regards quality, quantity, and the realisation of the variety of uses to which cement can be adapted. That country produces about 38 per cent., or more than one-third of the world's output. France comes next, with about 9 per cent.; the United States follow with about 8 per cent.; Belgium produces about 7 per cent., and Russia about 6 per cent. All other countries combined produce about 8 per cent. The total world's output of Portland cement to-day is about 40,000,000 barrels annually.

The author says, "It seems almost incredible, but it is, nevertheless, a fact, that in this country where cement was first used, and has been and is so extensively used, unlike Germany, France, Russia, and several other countries, there is *no standard cement test.*"

The author then proceeds to show to what extent the specifications of engineers and architects differ as to the test necessary for the cement to pass. He shows that in several works of considerable magnitude recently completed, and designed by well-known engineers, the seven days' tensile strength test specified for neat cement was 350 lbs. per square inch; while he refers to other works where the seven days' neat cement test per square inch was as much as 800 lbs. He then refers to others that were between these two extremes, viz., 400 lbs., 450 lbs., and 700 lbs. per square inch respectively, and yet each of these works in which cement was used were similar, some almost identically of the same kind.

He points out the fallacy of the old idea of considering that cement that went over 450 lbs. on the square inch was over-limed, and therefore not satisfactory.

He urges that a 28 days' test, as well as a seven days' test, is necessary in order to determine the regular increase of strength with age, the latter taken alone (as is the usual custom) he maintains is not a test at all, it is a complete fallacy to suppose that it is, and he most strongly recommends, as the most reliable test, a sand and cement test.

The author further maintains that a compression test is necessary, although seldom adopted, and points out how such a test may be made.

He then proceeds to describe what he considers the test should be as to weight, specific gravity, quickness in setting, fineness in grinding, soundness, and chemical analysis, and points out some of the popular fallacies concerning these tests.

He then concludes his paper by giving a summary of the specifications of nine well-known engineers and architects, which clearly shows how great a variation there is between them (no two of the specifications being exactly alike), *and how necessary it is that a standard cement test should be adopted in this country.*

He says: "It is extremely gratifying to know that the Institution of Civil Engineers, with the assistance of other institutions, has appointed an Engineering Standards Committee, which has for some little time past devoted much time and consideration to the standardization of various engineering materials, such as tram-rail sections, iron pipes, and other engineering materials. Portland cement, he has no doubt, will at an early date receive their careful consideration.

VENTILATION IN FACTORIES AND WORKSHOPS.

By H. M. ROBINSON.

ABSTRACT.

GENERAL ventilation is the renewal of the air of the workroom; local ventilation is the removal of the dust fumes or other impurities generated in the process of manufacture.

No standard as to amount or kind of ventilation has been laid down by Parliament as yet, but a minimum cubic space for each person employed is fixed by the Factory Act.

The best test as to the sufficiency of the ventilation is the proportion of carbonic acid gas found in the air. The standard recommended by a departmental committee recently appointed by the Home Secretary is a maximum of twelve volumes of carbonic acid in 1,000 volumes of air. To maintain the air at this standard, natural or artificial means of ventilation must be used. The air finds its way into a room through the walls, roof, and floor, and a constant change is taking place; this with the chimney opening and the window is generally sufficient for small workrooms where the cubic space for each person is ample.

For large rooms special openings are necessary, such as ventilating shafts through the roof or outside walls, openings into the chimney, or louvre openings in the roof where they are possible, and inlets such as Tobin tubes, etc.

The means of ventilation should be under the control of some one responsible person, and the openings must be of a fair size and sufficiently numerous; this is most important.

Artificial Ventilation.

Artificial ventilation is generally obtained by the use of fans. The vitiated air can thus be drawn out or fresh air blown in. In very large rooms both systems can be worked together, but the inblowing fans in this case should be run at a somewhat higher speed, or be slightly larger than

the exhaust fans. Considerable care and skill are required in fixing the positions of the fans.

Local Ventilation.

The removal of dust, fumes, etc., generated in any manufacturing process is best effected by an exhaust fan. Ducts should be led from the fan to the point of origin of the dust, etc. If this point cannot be entirely covered in, a hood or bell-shaped opening should be placed at the end of the duct as near as possible to the source of the impurity.

If the dust is heavy, a fan of the centrifugal type should be used. The fumes and heat caused by ordinary gas lights may be carried off direct in this way with very great advantage.

Mr. Gilbert Thomson (Glasgow) said that in the case of offensive manufactures it seemed to him there was a great deal of importance, not only from the actual workshop point of view but also from the public point of view, in what became of the offensive products of the trade. They might draw them away from the workshop and discharge them into the outside air, and thereby cause a wider nuisance. From the workshop point of view, Mr. Robinson's paper was admirable. It was right to remove the dust and fumes from the workshop, but there were others interested in the surrounding neighbourhood, and he would like to hear their point of view included in the discussion.

Mr. H. Robinson (Glasgow), in reply, said the absence of discussion evidently pointed to an agreement with his paper. As to the remarks of Mr. Thomson, he suggested that in some portion of the room there should be a settling chamber, into which injurious dust or matter should be blown by the fan. With regard to the cause of draughts in factories and workshops, it was greatly due to the fact that the means of ventilation were not made use of until the atmosphere of the room had got bad and hot, and the result of opening any ventilation apparatus was to produce a draught. If, as he suggested, the means of ventilation were under proper control, and were used directly the factory was opened, the air would be kept in a much cooler condition, and the tendency to draughts much diminished.

Mr. T. Reader Smith (Kettering) also took part in the discussion.

SCHOOL VENTILATION.

By ALFRED GREENWOOD, M.D., D.P.H.,
Medical Officer of Health for Blackburn.
(MEMBER.)

ABSTRACT.

ALTHOUGH the number of papers and discussions on this important subject is large, the recent combination of the education authority and the sanitary authority has again brought the question into prominence.

In many towns the medical officer of health has already been appointed medical officer to the education authority.

Probably in many cases the new authority will require a report upon the condition of the school buildings under its jurisdiction, and in my own case I was requested, as medical officer of health and as medical officer to the education authority, to prepare a detailed report upon the sanitary conditions of the fifty-two public elementary schools at Blackburn.

I thought that it would be of some interest to this Congress if I gave a short account of the methods and results of my investigations.

I first prepared a spot map showing the name and exact locality of the fifty-two schools, and then proceeded to examine each school in detail, covering every possible sanitary condition. Also, a plan drawn to scale (30 ft. to 1 in.) was prepared at each school.

In describing the schools seriatim the following points were noticed:— A brief description was first given dealing with the EXTERNAL conditions, such as condition of buildings, playgrounds, sanitary conveniences, etc. Then measurements and observations were recorded of the INTERNAL conditions, such as heating, natural and artificial lighting, cloak-room accommodation, walls, floors, etc. Each room was then dealt with separately in respect to floor space, cubic space, ventilation (inlets and outlets), and lighting, per scholar. The special conclusions and recommendations for each school followed next, and the plan drawn to scale showing the arrangement of the rooms completed the description of the school.

159 samples of school air were analysed by Pettenkofer's method for

the amount of carbon dioxide gas, and the air of the schools was also examined bacteriologically.

The subject of efficient ventilation of schools is an exceedingly difficult problem. It has involved a large expenditure of time and money. Installations have been fixed at great cost without much satisfaction, and even now there are many diverse opinions on this matter.

All will agree it is extremely important that the air of schools during school hours should be as pure as possible. There is no doubt that bad ventilation conduces to the spread of infectious diseases, as measles, diphtheria, scarlet fever, tuberculosis, etc., and also prevents the maximum benefit of the teaching from an educational point of view.

It is well known that persons engaged in out-door occupations, such as farmers, labourers, etc., are stronger in physique than those who are compelled to follow sedentary occupations inside, such as clerks, etc.

As the latter cannot otherwise earn their living, and as children cannot be taught out of doors, every effort should be made to insure that the air which they have to breathe is as fresh as possible.

The average frequency of respirations may be taken to number 16 per minute, and the average volume of each breath as 30 cubic inches. The volume of air expired is about 17 cubic feet per hour. This air contains ·6 cubic feet of carbon dioxide gas as well as moisture, and has an increased temperature (78° to 81° Fahr.). If it were possible to take this away immediately, before it could mix with the other air, 17 cubic feet of fresh air supplied per head per hour would be sufficient. As this cannot be done, one must decide how much fresh air is required to dilute the impure air suitably. Generally speaking, the air of a room cannot be changed more frequently than three times in one hour. This, of course, does not apply to very hot weather. The air should be able to move freely about a room, as it may stagnate in recesses.

I am of opinion that in many cases sufficient advantage is not taken of the means of natural ventilation already present.

Natural Ventilation.

This is the system that obtains in the majority of the Blackburn schools, and it is dependent upon wind, currents of air due to differences in temperature of the air, inside and outside, and also upon the other currents due to the heat of fires and gas jets.

When air is heated it expands, and when it cools it contracts. Hot air rises to the upper parts of a room, and cold air falls to the lower parts. Moist air also rises, as the vapour of water is lighter than air. The outlet

openings should, therefore, be near the highest parts of a room, and the inlet openings for fresh air should be arranged in such a way (about 5 ft. above the floor) that the air is properly diffused without draughts, and so that it tends to go upwards, in order that before descending to the lower parts of the room it mixes with the other air in the room. The introduction of fresh air should be distributed at several points along the side of the room. Air finds its way into a room by the doors and windows, and in a less degree by the ceilings, walls, and floors.

Windows should be made to open at the top and at the bottom. The lower portion should be constructed like a sash window, and the upper parts should be fixed with sides and hinges below, so as to be capable of being pulled inwards to the room. The hinges should be housed so that when the hopper is open there is no space between its lower part and the adjoining part of the window. When open, the result is like a Sheringham valve ventilator in use. These are also known as Hopper windows, and they are an excellent arrangement. When there is cross-ventilation, and windows are arranged in this way, one or more may be kept open at all seasons of the year. These hopper windows cause the air to enter in an upward direction. If the sides above mentioned are not provided, air may flow in at the corners and cause a draught. As to whether windows should be opened at the top or bottom, or on one side of the room or the other will require intelligent action on the part of the teacher.

These hoppers may be placed in upper or lower panes, and should be arranged so that they may be screwed inwards, much or little, according to the force and direction of the wind. The use of poles and window cords to open and shut the hoppers is less efficient than the screw arrangement.

The top of the window may act as an outlet in cold weather, and as an inlet in hot weather. Louvred panes, and various kinds of hit-and-miss ventilators may be used. Also, a board may be placed below a lower sash so as to raise it one or two inches, and provide a space between the upper and lower sashes for the air to enter in an upward direction.

I feel sure that too much stress cannot be laid upon the importance of windows as a means of ventilation. In the natural system, they are by far the most important factors.

In many school rooms all the windows are on one side of the room. In these cases two or three windows should be opened at the top so that some of these openings may act as inlets, and others as outlets.

Ventilating fireplaces have an air chamber behind the grate which is

heated by the fire. Fresh air is admitted from a pipe from outside, it is then warmed, and flows into the room.

Other special means of ventilation are: perforated bricks, Sheringham ventilators, Tobin tubes, McKinnell ventilators, perforated ceilings, etc. Some of these are intended to act as inlets, but under certain conditions they may all act as outlets.

Natural ventilation can only be carried out efficiently when cross-ventilation, or perflation, is proper.

An open fireplace, *per se*, practically only removes air from the lower parts of the room, although when a fire is burning, about 14,000 cubic feet of air per hour are removed. But if used in connection with a chamber fixed behind the chimney, communicating by its lower and upper parts with the open air and with the upper part of the room respectively, ventilation is rendered more efficient.

In heating by hot water pipes or steam pipes an attempt should be made to arrange them so that they can heat the incoming air, and thus assist ventilation.

Outlet trunks in the ceiling, carried to the outside air, should be constructed in such a way that the air is not cooled too much during its escape. Reliance should, therefore, not be placed upon the temperature of the incoming air to heat the room. The heating of the room should be carried out apart from this by means of fires, hot water pipes, radiators, etc. Inlets and outlets should communicate directly with the external air.

A permanent ventilation inlet opening of $2\frac{1}{2}$ square inches per head, as recommended by the Board of Education, does not seem sufficient for all conditions.

It is generally calculated that one square inch of unobstructed space will only allow 125 cubic feet of air to pass through per hour; so that for every 1,000 cubic feet of air needed, 4 square inches of permanent opening are necessary. This size of opening is necessary under the most favourable conditions, which are rarely present, but in order to obtain good results under less favourable circumstances a larger opening is necessary —even 6 or 8 square inches per head.

The Massachusetts law requires 30 cubic feet of pure air to be supplied each minute per pupil, *i.e.*, 1,800 cubic feet per head per hour.

Artificial Ventilation.

This involves either the propulsion or extraction of air, the establishment of a plenum, or vacuum, in the room to be ventilated. This may be carried out by revolving fans, ventilating ducts, etc.

If extraction be employed, the sources of supplies of fresh air cannot be controlled so easily as in the case of propulsion, where the air is taken from one source only.

The advantages of artificial ventilation are that it is constant under all conditions, and that the air may be suitably prepared as regards heat, purification, and moisture, and also that the source of fresh air and the volume delivered may be regulated.

I think it is unwise to install artificial ventilation with windows which cannot be opened. Doors and windows should be taken into consideration when providing outlets. It is desirable to flush even mechanically ventilated school rooms with open windows during playtimes. Open windows are also extremely valuable in summer weather, whatever may be the system of ventilation.

The question of artificial or mechanical ventilation is also closely associated with the warming of the school.

Care should be taken to prevent the air of the room from becoming too dry, and also to send in sufficient air.

Regarding efficient and mechanical ventilation, it should be remembered that a wrongly applied system may give bad results. Also, if the inlets and outlets are not placed correctly, the air may be driven through without affecting the greater volume of air in the room.

A Select Committee was appointed in 1902, to inquire into the ventilation of the House of Commons. After examining eminent witnesses, they have issued a report which has recently been printed.

This Committee had before them the following proposals for ventilating the House:—

1. The plenum system.
2. Exhaust system, with flow from above downwards.
3. System of inflow at the sides, and outflow at both the roof and the floor.

The Committee could not recommend the adoption of any of these three methods.

They also recommended the institution of an inquiry into problems of ventilation still unsolved, with the view of introducing further improvements in the present system.

Summarising my conclusions regarding the ventilation of Blackburn Schools, I may state that:—

1. Natural ventilation is easy to manage, subject to certain conditions, which I have named, and will be more efficient if the fullest advantage is taken of this means.

2. In some schools provided with mechanical ventilation frequent reliance is placed upon natural ventilation.

3. There is a diversity of opinion as to the value of the known systems of mechanical ventilation, and there is a need for further inquiry upon this subject.

Examination of Air for Carbon Dioxide Gas.

During December, 1903, and January, 1904, I have analysed 44 samples of outside air in various parts of Blackburn. The average amount of Carbon Dioxide (CO_2) present was 4·37 per 10,000, and the range was from 3·1 to 6·6 parts per 10,000. These 44 analyses included several samples of air taken on foggy days, when the results were 6·1, 6·2, 6·3, 6·5, and 6·6 parts of CO_2 per 10,000. Excluding foggy days the average of my analyses of outside air was 4·02 per 10,000. The highest result I obtained at any time in outside air was 6·6 in 10,000.

The average of six samples of outside air collected in various parts of Blackburn, during the latter half of March, 1904, gave 3·6 parts of CO_2 per 10,000.

As the proportion of CO_2 in the outside air varies on different days, it is necessary to analyse the outside air each day when samples of inside air are examined. This has been done in these experiments.

On foggy days a greater proportion of CO_2 occurs in the air of rooms than on clear days. Also the proportion of CO_2 is greater in a room where the gas jets are burning. One gas jet burning 4 cubic feet per hour consumes the oxygen from 21·32 cubic feet of air.

CO_2 is increased by respiration, combustion, putrefaction, and fog, but diminished by vegetation, rain, high winds, and ventilation.

Analyses of School Air.

The recent investigations into the air of Blackburn schools may be tabulated shortly as follows:—

Number of Analyses.	Average amount of CO_2 per 10,000.
159.	9·69.

or,

Parts of CO_2 per 10,000.	Under 10.	10 to 15.	15 to 20.	20 to 25.
No. of samples examined ... 159	95	52	10	2

Of these 159 samples, 107 were collected in Blackburn Schools during December, 1903, and January, 1904, when fogs occur, and when gas is

often burning in the rooms. The average of these 107 samples showed the presence of 10·4 parts of CO_2 per 10,000, ranging from 4·04 to 20·8 parts.

The remaining 52 samples of school air were collected during the latter end of March, 1904, and the average of these showed the presence of 8·2 parts of CO_2 per 10,000 parts of air, ranging from 4·2 to 15·2 parts.

These results compare very favourably with analyses of school air in other districts, and also with the results of the examination of 88 samples of Blackburn Schools taken by Dr. Wheatley in 1897, which showed on the average a little more than 15 parts of CO_2 per 10,000. This improvement may be explained by the fact that in the intervening period much has been done in the way of improving ventilation openings, and that teachers generally now recognise the importance of this question more than they did several years ago.

I am sure that even better results than those recently obtained would follow if more attention could be given to the means of natural ventilation available.

Mr. Armstrong asked whether, in the carrying out of his experiments, Mr. Greenwood found any variation of CO_2 near the ground.

Mr. W. Key (Glasgow and London) said Dr. Greenwood appeared to recommend that the area per child should be increased, but to do so would increase the difficulty. He thought the proper thing to do would be to change the air of the apartment by an apparatus and be independent of the vicissitudes of the weather. He advocated the use of the plenum method of ventilation, and the expense of that could be met by reducing the height of the building. The whole cost of the installation could be met by reducing the space, and the grant earning power of each school would be increased, as with plenum ventilation the scholars did not get colds on leaving the school in frosty weather for the open air, and consequently the benches were always fully occupied. The change of air would be from 12 to 14 times per hour in the summer and 10 times in the winter, this being quite irrespective of outside conditions. It had been found by the late Professor Carnelly that when the air of classrooms was tested, in every case where windows were open on both sides of the apartment to get ventilation, that the teachers whose heads were above the window would get advantage of the fresh air, but that the children who were below the level of the windows were in a stagnant atmosphere. It was invariably found that

through ventilation by open windows did not reduce the number of micro-organisms in the air under the level of the window-sills. These were generally found to exist at the level of the heads of the scholars at a rate of 70 bacteria per litre of air, and the air had a strong school odour. By the downward method of ventilation the purified air reached the nostrils from above, and exhalations were cooled to the same temperature as the incoming air, and were carried away at the floor level. He suggested to Dr. Greenwood that, in dealing with Blackburn, he would find it well to have plenum ventilation. It was an entire misconception on the part of a well-known architect to say that in passing the air downwards into a room it had to meet with an upward current. Where the air was changed ten or twelve times in the hour the temperature was not higher at the outlets than the incoming air (except half a degree) even in a fully-occupied classroom, owing to the rapid renewal of the air, and so there was no upward current to be met. There were a number of other misconceptions about this system, but he asked that it should be given a test.

Mr. H. M. Robinson asked whether the samples were taken in the schools in the morning or the afternoon.

Dr. A. Greenwood (Blackburn), replying on the points raised in the discussion, said that he had not taken his samples at different levels in the rooms, but had taken them all at breathing level. He certainly could not agree with Mr. Key who spoke so strongly in favour of the plenum system of ventilation. He hoped to obtain much better results by impressing upon teachers the necessity of using the means of ventilation which were at hand, and he did not feel justified in recommending that any mechanical system should be supplied wholesale, so far as Blackburn was concerned. He did not think the expense would be warranted. He found that in the two mechanically-ventilated schools they had at Blackburn the results were no better than many obtained in the naturally-ventilated schools. The samples were taken at all times, but he could not incorporate the times at which they were taken in the paper. He found that the samples taken later in the afternoon were often the worst.

THE PAST, PRESENT, AND FUTURE CONDITIONS OF HOUSING UNDER THE PUBLIC HEALTH ACTS.

By JAMES G. D. ARMSTRONG, Prof. Assoc. Surveyors Institution.

(MEMBER.)

ABSTRACT.

ANCIENT historians have recorded many examples of sanitation of no mean order, but all these were based on what *seemed right, and not upon the results of ascertained facts and scientific research and bacteriological investigations.* There are no records of any systematic reforms till last century, and the first appears to be a pamphlet by Chadwick, in 1842, on "The Sanitary Condition of the Labouring Classes," and the Report of the Royal Commission on the Health of Towns, in 1844-5, from which sprang *the* first Public Health Enactments.

For about 150 years there was a tax on windows, which meant shutting out the sunlight and fresh air, now looked upon as the greatest of all health promoters and disease destroyers. This tax produced no less than £1,832,000 in 1850, when it was repealed, and its place taken by the inhabited house duty. Our legislature has decided these wrongs must be put right, and a study of the Public Health and Local Government Acts passed since 1848 clearly shows, and has laid down once for all the principle, that the responsibility lies on the owner—the responsibility of keeping dwellings and surroundings in a proper state of repair, and a condition not dangerous or injurious to health. This responsibility has gradually grown from the first enactments in 1847—1848.

Since 1875 the width of streets and the amount of yard space, the size of windows, and through ventilation and general construction, have been more satisfactory and done under by-laws, but in many cases the loose manner in which these regulations and by-laws have been carried out are self-apparent, and the evils arising from this looseness are becoming a serious concern and find the whole employment of many of our sanitary inspectors, the number of whom is being increased very largely every year.

The greatest part of the dwellings of the working classes have been built by speculative and sometimes, perhaps, often by jerry builders, whose ideas of sanitary and permanently healthy dwellings do not enter into the case of profits. This fact is one of the very greatest importance in its bearing upon public health. They look upon the requirements of by-laws *not as the minimum but as the maximum requirements*, and try to escape their responsibility at every point.

I must not be understood to say I condemn on the whole the speculative builder. He has been a most important factor in helping to decrease the troubles of overcrowding.

One of the most important data bearing on the housing question is a legal definition of "*overcrowding*." It is owing to overcrowding in *the cubic space in dwellings more than to overcrowding on area* that unhealthy conditions arise, and it cannot be denied that from this overcrowding in cubic space must be taken the first equations to be solved. Without such a definition and immediate extension of active building, all our labours to improve town dwellings have been and will be almost in vain. This is one of the drastic reforms which must take place, in order to prevent not only old houses but also new houses and houses otherwise constructionally habitable from becoming unhealthy. This may seem as interfering with the liberty of the subject, and may in some cases affect the value of property, but selfish desires cannot stand in the way of national health reforms, which have as their object the raising of not only the health, but the mental, moral, and physical capabilities of mankind.

The principle of prohibiting overcrowding is not new. Section 91 of the 1875 Act gives overcrowding as a nuisance, and Section 109 allows a closing order after two convictions, but overcrowding is not defined except as a nuisance dangerous or injurious to health, and it is left to local justices to say whether a house is overcrowded or not, and whose decisions are, in fact, chiefly influenced by whether there is other accommodation.

The Registrar General's returns give all houses as overcrowded which have more than two persons per room. This basis is also used in fixing the number of persons in housing schemes under the Acts. It is unreliable and unsatisfactory as no notice is taken of the cubic contents of the rooms, which should be taken and not the number of rooms nor the floor space thereof. If a minimum of 400 cubic feet per adult were fixed for all rooms, then subject to other accommodation being provided the solution of the equation would be partly in view.

No logical argument can draw a distinction between the responsibilities of an owner whose house is closed or pulled down under compulsion and

the owner who permits overcrowding so far as public health is concerned. Keepers of common lodging-houses, and houses let in lodgings and factory owners, are not relieved of the burden, and neither should owners of property tenanted by the poor. The rents of such houses are, as a rule, much more than they would be if the dwellings were habitable and situated elsewhere, and the difficulty and evils which have arisen in a great part owing to the large rise in value of land by the aggregation of population would so far as dwellings are concerned be transferred from the town and continued on outlying districts.

There is in Glasgow a local Act which gives power to the local authority to ticket one, two, and three-roomed tenements, stating the number of persons they can fitly accommodate, and this is applied to no less than about 21,000 tenements, having about 80,000 population, and a night inspection is maintained. In connection with the definition, overcrowding, this principle of registration should be made universal up to four-roomed houses, and the power to do so should be given to the local authority to be enforced on what buildings, streets, and courts it thinks right, and in their default an appeal to the grand jury of the district by a definite number of citizens.

The next point is that every dwelling should be complete in itself as a dwelling. Each tenant should feel he is a master of a house, and that it is complete *as a house.*

Some local Acts have got powers, for example, to force a sink being placed in every dwelling. The same principle also applies to the conversion of dwellings descended from the upper classes to the working classes, which should be converted into separate independent dwellings with complete sanitary arrangements, and included under the term *New Buildings.* Much cheap accommodation could be provided in the proper conversion of such houses. One of the curses arising from the want of statutory control is the tendency to increase one-roomed dwellings for family life—the life in which is degrading, demoralising, and inhuman beyond degree.

All associated houses, and all houses let in lodgings for the working classes, should also be registered if so required by the medical officer of health, and this should include furnished lodgings. The by-laws made under section 90 of the 1875 Act, only appear to be generally applied to the rooms of the very poorest, but no such restriction is implied by the statute, nor are furnished rooms included. I find in many towns there are large numbers of court houses furnished and let out in single rooms for family life, the rents of which are exorbitant.

Another important point is that it should not be possible to patch up a dilapidated or *worn out* dwelling to be used as a future dwelling when surrounded by property which has also served its day. A closing order should be made for its demolition, without the present necessity of first getting a justice's order to repair.

Housing Acts.

The Housing Act of 1890 is divided into three parts:

1. Unhealthy areas.
2. „ dwellings.
3. Provision of new dwellings.

The Housing and Amending Act of 1900 gives power to urban councils to buy land or acquire lodging houses outside their district.

2. Power to lease land for dwellings on building leases.

3. Appointment of a single arbitrator by the Local Government Board to buy land if purchased by agreement.

This Act repealed and consolidated all the previous Artizan and Dwellings Acts, 14 in number, the first of which was passed in 1851, except sections 3, 7, 8, 9, and 10 of the 1885 Act.

Section 7 is most important, and again asserts the owners' liability. This section runs as follows, and is an amendment of the General Sanitary Laws:—

"It shall be the duty of every local authority entrusted with the execution of laws relating to public health and local government to put in force from time to time, as occasion may arise, the powers with which they are invested, *so as to secure the proper sanitary condition of all premises within the area under the control of each authority.*"

Work previous to 1890 was done either under the Artisan Dwelling Acts, 1851 to 1885, or under private improvement Acts and Provisional Orders, but in no case have any of these schemes been a financial success *per se.*

The total loans under the Artisan Acts, up to 1890, was ...	£2,347,353
and under the 1890 Act up to 1902	2,683,300
	£5,030,653

Part 1 of the 1890 Act provides for clearing unhealthy areas which *cannot be remedied otherwise than by an improvement scheme*, and in almost every case the Local Government Board have insisted upon accommodation being provided on the same site for all or part of the dishoused tenants. This intention has, however, been proved to be impossible of attainment in almost every case, except, perhaps, at Liverpool.

It has been adopted by about twenty-three towns outside London, and £900,000 lent, among the largest being (the figures are approximate)

Manchester ...	£285,000	Salford ...	£70,000
Sheffield	96,500	Brighton ...	62,600
Plymouth ...	78,200	Wigan ...	76,600
	Southampton ...	£46,500.	

There is a striking lesson in the awards of the arbitrators, and in private purchase, in some of these schemes, for example:—

	Total Claim.	Settlement.
Boundary Street, London (private settlement) ...	£385,656 ...	£228,317
„ „ „ (arbitration) ...	71,677 ...	38,215
Southampton (arbitration)	40,000 ...	32,000

The price per acre is also conspicuous.

London County Council	£21,460
„ Reid's Brewery	66,000
„ Boroughs	22,200
„ Artisan Dwellings Acts... ...	31,503
Wolverhampton	16,740
Sheffield	18,000
Salford	35,000

Other prices that have been paid are—

Edinburgh (High School yard)	14,520
Glasgow	from £7,260 to 31,650

A glance at these prices per acre must convince the most sceptical that such schemes for *housing* purposes can never succeed, and demolition schemes inflate the value of the land far beyond its real worth.

The procedure under this part of the Act has been the subject of many papers and discussions, and is held to be, almost universally, too expensive; it has been abandoned by many towns, and judging from the above figures and the powers given under Part III. should become a dead letter except for town improvements, and even for the latter private Acts and Provisional Orders appear to be less costly.

Part II. provides for the closing of uninhabitable dwellings and their demolition at the owners' cost, also for the demolition of obstructive buildings, *i.e.*, buildings not in themselves insanitary, but which stop ventilation or otherwise impede remedial measures. The local authority may purchase such buildings, and the arbitrator has power to award part or all the cost on the houses improved on the "Betterment Principle." A careful study of many slum districts convinces me that if these obstructive buildings were more generally demolished, many courts and side-streets could be

cheaply improved and the houses made sanitary without clearing the areas, and as most of the dwellings are already very old they would sooner or later either be rebuilt or come under a closing order. One of the best methods which suggests itself is the demolition of the houses at each end of the courts, particularly the house which adjoins the passage to the back court, thus *throwing the court open to view from the street.*

Part III of the Act is adoptive, and under it land may be purchased anywhere (Amending Act of 1900) by urban councils, and dwellings erected whenever they think fit, or they may lease it, or build on it, or exchange it for other land; may furnish dwellings, provide half-acre gardens, or build lodging-houses. Over 100 authorities have adopted Part III, and borrowed over a million pounds outside London. Existing houses may also be converted under this part.

The cost of land bought under these powers are as striking as under Part I, for example (approximately)

38½ acres	C. County,	Tooting, per acre	£1,150
31 „	„ „	Norbury „	645
225 „	„ „	Tottenham „	400
238 acres,	Manchester ...	per acre	£150
4½ „	Hornsey	„	600
2 „	Highgate	„	1,000
6 „	Richmond	„	700
29½ „	Plymouth	„	522
5 „	Southend	„	300
42 „	Sheffield	„	100
60 „	„	„	150
33 „	„ (arbitration)	„	250

These are examples where 200 to 300 acres of land have been bought for the same cost as clearing one acre in the centre of the town. Most of this land is not yet built upon, but the rents will probably work out at about 2s. 4d. to 2s. 6d. per £100 complete cost for provincial towns.

The often quoted Port Sunlight I shall pass by saying that the houses are let at a reduced rent of about 5s. per week, with a yearly loss of several thousand pounds, and at the other model village, Bournville, the houses are let at 7s. to 7s. 6d. a week, and the scheme was originally heavily subsidised. Each house has 600 to 800 yards of land.

There are numerous other companies housing many thousands, and a consideration of the development of the suburbs of all our large towns by the speculative builder is appalling. This method of development does not

meet in a desirable way the difficulties of either the scarcity of houses or the evils of overcrowding, and does raise the rents and increase beyond its proper degree the unearned increment. This brings us face to face with the powers granted to local authorities under the 1890 to 1900 Acts, allowing them to buy land anywhere and build and borrow at 3 to $3\frac{1}{2}$ per cent. They may also charge the sinking fund to the rates, thus fixing the rents based on interest, rates, repairs and management, and this in competition with private builders. The result in principle is a direct blow against the past methods of land development, and whether surveyors, land agents or land owners, they must recognise it and amalgamate their efforts with the local authority.

It is often remarked that local authorities should only build models for others to copy. With such a remark I cannot agree, and a study of the pitch to which housing has arrived clearly shows that it is the duty of every local authority at once to secure large areas of land on the outer outskirts of their towns, and hold them for building purposes.

The increasing incidence arising from the aggregation of population must be checked, and it appears that what I shall call the *localisation of agricultural land—i.e.*, land not ripe for building—alone will stop it; nor does this localisation—*i.e.*, the purchase and development by the local authority—appear difficult.

If the land were bought at its present worth, based upon its agricultural returns and its *present incidence* valued separately, and the latter paid upon development of the land, the whole would be transferred to the authority to hold on trust for the ratepayers, who could either pay for it outright and immediately develop it, or leave it in the hands of the sellers, the land authority paying a nominal sum yearly, and thus leave its present use and occupation to a great extent unaltered, *any increase in the value of the products* still remaining with the owners, but for which there would be no further valuation upon development.

For example: 100 acres agricultural land at £70 = £7,000; £7,000 at 3 per cent. = yearly interest of £210; or yearly rent of £2 2s. per acre.

The probable increased incidence which might arise, say during the next ten years, would have to be valued, and might be 50 per cent. of the purchase money, in this case say £35 per acre to be paid upon development, or £3,500; *i.e.*, the land would cost £105 per acre, plus a nominal yearly rent of, say, 5s. an acre, which would cease upon completion of purchase, and which rent in 20 years would only add £8 per acre to the purchase price.

If a small part of the land were developed at once, the nominal rent and part of the interest on the outlay could be created.

No doubt it may appear that the State should not interfere in this way, but it must be remembered that every year our Legislature are interfering and making laws which assert the right of the State to take possession of property for public or private interests, to tax it, or to regulate and restrain the rights of the owners. There is no theory of the principle of tenure in land which does not admit of the ultimate authority of the community. The privileges of the greater mass can never be ruled or controlled by the wishes of the individual.

The whole principle of localisation, except as to method of payment, is embodied in the Housing Act of 1900, Section 1, which says the local authority may acquire land outside their district for supplying their needs.

Local authorities have now powers to acquire allotments, dwellings, schools, gardens, recreation grounds, libraries, baths, hospitals, gas or electric works, water works, sewage works, burial grounds; have been allowed to erect shops—in fact to build a complete town, except places of worship, hotels, and factories, and nearly all may be done outside their district. Add powers for places of worship and factories, then the local authority has powers to build a complete *localisation town* within or without their district.

The land would be laid out on a general plan laid down beforehand, noting which way traffic should chiefly extend, thus fixing all main streets, etc., as I am informed is now being done in many German towns. The ratepayers, as ground landlords, would have a hold over all repairs, and there would be no terminable leases which are peculiar to England, and which as a rule either allow the property to fall into disrepair, or prevent a tenant or lessee spending money on improvements.

Many suggestions have been made to solve this housing question, none of which are effectual, such as—

1. Taxation of land values.
2. Taxation of vacant land.
3. Exemption from rates.
4. That the central authority should fix the rents of all new houses (Parliamentary Committee Report, 1902).
5. That owners should fix the assessment of their land, and give the local authorities or State option to buy on this basis, while they pay taxes on same basis.
6. That local authorities should have power to build dwellings on land, costing £67,000 per acre.

7. That the overcrowded tenants should be removed into sanitary areas and paid a subsidy for a certain time, equal to the part cost of clearing, say £50 per head.

8. That the property should be formed into a trust among the owners, for future development.

9. The decentralisation of factories.

10. Garden cities.

None of these go to the essence of the question, except the last two, and they really mean new towns.

No remedy will ever be found except under compulsion, as the history of all national reforms proves, *e.g.*, Public Health Acts, Factory Acts, Railway Acts, Education Acts, and the same would happen with a "Localisation of Land Act," in which I submit there would be more good than any scheme yet proposed.

Rapid and cheap transit must accompany localisation schemes. The rapid development of electric traction, the gradually increasing use of a universal penny fare are working wonders, not only for working-men but in increasing unearned increment, and I fail to see why this sudden increase should go to the land owner, or be taxed for national expenditure, instead of going to those who earned it. Notwithstanding much adverse criticism the minority report on local taxation must be correct when it says site values are increased by public expenditure.

An extra ride of a mile on an electric tram car is as nothing, and by localising the land just outside that which is "ripe for building," and extending the tram lines, it would soon develop. The Midland and Great Central Railways have, at Sheffield, introduced zone tickets ranging from one shilling to two shillings per week to suburban stations working out, in some cases, at one penny per nine mile ride. This has been brought about by the universal penny tram fare from the centre of the city. Seven miles can be travelled for twopence on the Sheffield cars, and the corporation have bought estates at both ends of the town for housing purposes. As an instance of municipal trams the passengers carried in five towns in one year ending June, 1903, were—

Glasgow	150,000,000
Liverpool	108,900,000
Manchester	66,849,500
Leeds	57,240,000
Sheffield	55,000,000
Total	437,989,500

or about $\frac{1}{6}$th the total population of the world!

The first tramway in England was laid in 1860. The first Tramway Act was passed in 1870. The passengers carried in 1900 were 1,065½ millions.

The total number of season ticket holders on the railways in same year was only 1¾ millions, and all passengers, 1,142¼ millions, being little more than tramways.

The following table shows the development more strikingly for electric trams, viz :—

	1894.	1897.	1899.
Great Britain	70 miles.	440 miles.	900 miles.
Germany	164 „	1,000 „	2,300 „
France	68 „	448 „	800 „
Totals ...	302	1,888	4,000

The increase of tramway passengers in England from 1890 to 1900 was 100 per cent., and in railway seasons 1880 to 1900, 357 per cent. The increase of German mileage is also remarkable, being 1,460 per cent. in five years against England's 1,280 per cent.

An analysis of the returns of 110 British lines shows average profit of 5 per cent., and increased mileage shows greater returns. Why not at once extend them into the country districts? In the absence of other remedies why not form large companies and develop the land, under an agreement with the local authority that the latter will instal trams if houses of a certain capacity, with gardens, be built and let at a suitable permanent rent?

The cost of materials and labour is a most important question, and can only be reduced by the introduction of cheaper materials and other means of building which no doubt will come about in this inventive age of wonders.

Most municipal work costs about 20 per cent. more than ordinary building, owing to many useless restrictions which should be abolished, among them being—

1. Bringing party-walls through the roof—the idea of a late metropolitan fire brigade officer. How often do we hear of cottage roofs being burnt down? If the slate laths did not run over the party-wall and the slates were bedded solid on the wall it is all that is necessary—this alone sometimes adds 4d. to 6d. to the weekly rent.

2. The by-law which insists on all rooms, if not in the roof, having a level ceiling, *i.e.*, the room must be the same height throughout. The London County Council cottages at Tottenham have a bedroom over a pro-

jecting scullery, and in order to call it a room in the roof have put on a Mansard roof, sloping only about 4 inches from the perpendicular, in order to avoid raising the walls, so as to get a level ceiling at the eaves inside.

3. The increased thickness of walls by one-third if made of concrete. There is a large field open for a cheap form of concrete construction.

4. The increased thickness from 9 inches to 14 inches if an attic be put in the roof.

5. The necessity to make all rooms 9 feet or more clear height.

The *capacity* of a room should be taken, *e.g.*, suppose we take 400 cubic feet for the limit and the clear height at 8 ft. (which is allowed by the Local Government Board) it would mean a sleeping-room

10 ft. × 10 ft. × 8 ft. for 2 adults,
and 10 ft. × 12½ft. × 8 ft. for 2 adults and 1 child,
and 8 ft. × 6½ft. × 8 ft. for 1 adult or 2 children,
and 10 ft. × 7½ft. × 8 ft. for 1 adult, 1 child or 3 children.

Rooms should be placed so as to get the sun during some part of the day.

No one-roomed houses should be allowed except with a separate scullery and food cupboard. Three and four-roomed houses are in greatest demand, as shown by the last census, with small ratio of two-rooms, and these at about 1s. per room per week. It must not be forgotten *the ideal should be not to provide a rent to suit the wage, but to provide a sanitary home the wage will allow.*

There is one other point I would mention—a possible action in a very far-reaching field, *viz.*, the action of Co-operative Societies under the Small Dwellings Acquisition Act of 1899, and Section 67 of the 1890 Housing Act. If land were localised and leased at low permanent ground rents to the unions, and money borrowed from the local authority at about 3½ per cent., houses could be let to their members at a much lower rent than by private enterprise, and the fact that co-operative shares cannot be speculated in, prevents premium being put upon the rents.

The chief points I submit for discussion are :—

1. The "localisation" of land.

2. A legal definition of overcrowding, say 400 cubic feet per person in sleeping rooms.

3. A cheaper method of construction.

4. Joint action of extending electric tram lines by local authority, and the rapid development of outlying estates.

5. The compulsory formation of a trust by the owners of insanitary

houses, and areas for future development by the owners *pro ratio* chiefly for business premises.

The development of estates by large trade unions and co-operative societies for the benefit of their members.

Mr. Burgess (Glasgow) said he thought he might supplement the paper with some details from the experience of Glasgow, that might bring home the lesson which the paper conveyed. In Glasgow they had dealt with the housing of the working classes, but they had not done it under the powers of the Housing of the Working Classes Act, but always under special Acts. Under the Act of 1866 and the Act of 1897 the city had made street improvements and cleared insanitary areas. Under the Act of 1866 the ratepayers of Glasgow had had to contribute to the cost of clearing the Salt Market no less than half a million of money. No one interested in that particular experience could tell how it worked out at the present moment. They were now clearing an area under the 1897 Act close upon Stockwell Bridge. The houses were in process of demolition, and on that land there would be a loss of over £7 per square yard. Take the section dealing with insanitary houses. Within the last two or three years, under the convenership of Bailie Burrell, they had begun to put into operation the powers dealing with insanitary houses. They were now compelling owners of insanitary houses to remove them, and were giving no compensation, and this had been felt so severely by some of the owners that a short time ago they had a requisition from ratepayers that an area should be transferred under Part I. as an insanitary area. They found that this requisition had been signed exclusively by landlords and factors, and of course they did not agree to their prayer. He was sorry to say that the Housing Commission which had reported was likely to do them some harm in this respect, by suggesting that they should proceed under section 38 instead of section 32. Section 32 gave no compensation to houses which were insanitary; while section 38, which dealt only with obstructive buildings, suggested compensation. The Committee, anxious to bring into play the principle of betterment, suggested that they should charge the owners of the property a portion of the compensation, but they felt it would not be an advantage to proceed under section 38. With regard to Part III. of the Housing of the Working Classes Act there was not the least doubt that they could build, and it was in this direction that municipalities should act. They heard a great deal about the land question. They had in Glasgow in the possession of the Corporation fifteen acres of derelict land that should be applied to housing at 10d. per square yard, within two miles of the Exchange and abutting upon one of their parks. They had built within the city in a congested district on land which cost 7s. a yard, and in other cases on land which cost 4s. a yard, and they had put on the land one and two-apartment

houses. The two-apartment houses cost £140 to build, and they were letting them at an average rent of £8 a year. Under their Act of 1897 they obtained power to purchase twenty-five acres of building land, and by building these tenements they could let two-apartment houses at £8, which was 30s. less than houses let in the same district, and they could let one-apartment houses at £5, and if they could borrow at 100 years instead of 60 they could let these two-apartments at £7 without resorting to the rates. If they could have these one-apartment houses reserved for the poor widow or old couple, or two girls who want to live together, there would be no difficulty in the matter, but in the city of Glasgow they had 104,000 people living in one-apartment houses, with a density of 3½ persons a room. Under such circumstances as that he submitted they were not on the right road. He submitted that their local authority required some strong remonstrance so that they should not encourage, as they did in all their building schemes, the perpetuation of one-apartment houses. The municipality built more one-apartment houses than any other builder in the city in proportion, and if they did that they could not go with clean hands to put down the evils of overcrowding.

Dr. J. F. J. Sykes (London) said that Mr. Armstrong had gone more into details than one generally found in a paper of this kind, and had referred to what he called the localisation of land. He concluded that Mr. Armstrong meant that the Corporation should have an option on the land, and if he did mean that then he (the speaker) saw a difficulty. Would the ratepayers of a large town or city like their representatives to put down a certain sum of money, either at the moment or to guarantee it for the future, for a large area of land in order that they might have an option upon it, and so block the land from being used for any other purpose for a certain period until they were ready to use it themselves. Everyone knew that they could not prophesy what was going to happen to land in the future, and if they purchased an area a long way ahead, at the time they might be ready to use it it might have gone up in value or gone down in value for the particular purpose for which they wanted it. It might have gone up in value for other purposes, but not for the particular purpose they wanted it for. It might happen that the land would have become surrounded with factories and it might then be very proper land to build factories upon but the Corporation might come to the conclusion in 20 years' time that it was undesirable to build houses upon it. The answer to that of course would be that the Corporation would sell it at enhanced value and purchase land elsewhere. That at once opened the question of the trading in land by municipalities. He did not, himself, think that Parliament or the people of this country would allow that to take place. That was where he saw a difficulty in the option and localisation of land. It happened to be his lot just now to be interested in the purchase of certain lands in connection with a housing scheme. That land had certain curious restrictions upon it: it could only be used for certain

purposes and there were certain disadvantages about it. That land might have been bought at any time within the last eight years at a reserve price of £1,200, but when he told them that the price now asked for it was £12,000 it would help them to realise the enormous prices asked for land when a local authority wanted it. In that case the matter would probably go to arbitration, as the advance was ridiculous. Then, when they came to the question of 400 cubic feet for adults, he felt it was most necessary to have a legal definition of overcrowding, and this he strongly supported. General Booth at Hadleigh and other places had excellent encampments, and he saw no reason why large populations should not be housed outside the town in the summer months and carried to and fro by tramcars. It was being done on a fairly large scale near London, and the extension of tram-lines would very much help. Some idea of that kind might be adopted with houses more substantial than a tent, but which were not built to last 100 years. He took it that Mr. Armstrong's idea was to buy a parcel of land and build and then run a tramway to it, and the inhabitants would follow, and he believed that was the idea the London County Council had adopted. The last question was that of one-roomed dwellings. He hoped that for families one-room dwellings would never again be constructed by local authorities. He was glad to say he had succeeded in convincing his authority that one-room dwellings were a mistake, and they had only an odd one here and there in blocks of buildings. He certainly hoped that at that meeting some resolution would go forward that it was desirable that 400 cubic feet should be adopted for sleeping rooms, and that one-roomed dwellings should not be built.

Dr. Honeyman (Glasgow) felt it was of the greatest consequence in any large community that there should be one-roomed houses, and they had been accustomed to have them in Glasgow. It had been said by Mr. Burgess at another meeting that one vital objection to these one-room houses was that the death-rate in these houses was twice as high as the death-rate in the better class of houses in Glasgow. Anyone practically acquainted with the circumstances knew that was due, not to the house in any way whatever, but to the manner in which the houses were occupied. Mr. Armstrong himself admitted that it was not the overcrowding of houses but the overcrowding in the houses which was the cause of the high death-rate, and there was no mistake about it that that was the case. It was the kind of population which occupied the houses, and the character of the overcrowding that had constantly prevailed, which was the cause of the high death-rate. It had to be observed that in regard to the two-roomed houses the statistics were very similar. There was little improvement in the two-roomed houses, and, in point of fact, the house with two rooms in it was rather a temptation for the tenant to introduce lodgers. The origin of the crowding of people into houses where there was probably not 100 cubic feet of air space for each was that the people who indulged in it for the most part could not pay the higher rent. The greatest consideration in the question of the housing of

the poor (he did not mean the housing of the working classes generally) was that of cost. There was no mistake about it that they could have a cheaper house with one apartment than with two; and they very often could have a better house, because if they gave the same cubic capacity to a house of one apartment that they gave to one of two they would have a far healthier dwelling. He supposed that those present were for the most part accustomed to apartments in England which were supposed to be one-room dwellings, but which were all part of one house. He wanted, however, to impress on them that the difference between that class of house and those in Glasgow was enormous. The door of the one-room house in Glasgow was the first door one came to, and it opened into an apartment which could be kept in perfect order and in a perfect sanitary condition. He had gone into a tenement in a slum district to find the woman who looked after his office. He knocked at a door, and it was opened by a wretched woman with a haggard face, and he saw, as the door was open, a filthy floor, on which were two or three half-naked children playing with something. At the end of the room were a couple of shakedown beds apparently, which had been occupied during the night, a table, and a single chair. He asked for the woman he wanted to see, and was told she lived on the other side. He went to her room, and he found it in such a condition that he would not have objected to occupy it himself. There was a clean table, white with washing; the floor was the same; there was a little piece of carpet and a single bed; and near the window a table on which was a geranium in full bloom. Nothing could have been better and more suitable for this woman, who went about charing in the morning and worked at embroidery afterwards at home. He asked her why she lived in such a place, and she said it was because she could not possibly get an apartment to live in at the same price anywhere else within reasonable distance of her work, and that was a point to be considered. There were thousands in a city like Glasgow who must live near their work or else they would get none. It was all nonsense to ask these people to go into the country and to pay a shilling a week in tramway fares. They must be near the little jobs they could do or else go into the poor-house. It was infinitely better that they should be able to get a place where they could keep themselves clean and in a sanitary condition if they liked to. There were thousands who could not be better or more conveniently housed and who must have for the sake of cheapness the one-room house. It was all a matter of the condition in which the house was kept. In the instance he had given the houses were precisely the same, and it would be quite possible to keep them the same. They had the very worst of their population; the most drunken and the most dissolute huddled together in one-room houses, and the wonder was that the death-rate was not higher. He felt that there was a great deal of prejudice on the subject of one-room houses, and that was why he ventured to intervene in the discussion and tell the meeting what he knew.

Mr. James Munce (Belfast) remarked that this question of the housing of

the working classes was one not understood in England at all. He was present at a congress of engineers in that building three years previously, and saw a diagram on the walls of a workman's house to cost £278. What workman could afford to furnish, heat or live in a house of that kind? The mistake was that gentlemen who were very clever at building mansions did not understand how to build workmen's houses. The chief thing to consider was that the workman had only 15s. or £1 a week, and they had to build a house in which that man could live in comfort. He admitted that a large number of working people required to be taught cleanliness first, and that if they kept the houses clean the death-rate would be lower. In preparing a housing scheme at first they had to know what they were going to pay for the site, because if it was a place where they could get a good rent for warehouse purposes it was no place for workmen's houses. Some years ago in Belfast they cleared a very bad slum, and the Local Government Board allowed them to take a site about a mile off for rehousing, where the land was not so valuable. The land was taken at a rent, and the houses were built by private speculators, who had ever since been paid a large percentage for their outlay, while it had cost the Corporation nothing.* He thought it better for the municipality to let the land at a yearly rental for building on than to sell it outright. They did not want expensive buildings, because in twenty years' time the land might be much more valuable for other purposes, or there might be such improvements in workmen's dwellings that those built now would be left half empty. They wanted, therefore, property which could be converted into something else. He believed that in Belfast they had the best workmen's dwellings to be found in the United Kingdom, while the death-rate in the newer districts was not more than fifteen per thousand.† To his mind the whole point of the problem was to get the houses built cheaply. He saw a model house at the exhibition which looked very nice, but who would like to live in it? When a man got married there were *at first* only two inhabiting a house, but in a year or two there were two or three others to be provided for, and it was certain a family would not be able to live in the house in the exhibition. In housing the working people they must go into it from the working man's point of view, and not from the point of view of the millionaire.

Mr. Buckley (Dublin) asked if the author had given any attention to the provision of more cubic space for the room. If they laid down a definition such as suggested, it would mean that an ordinary family would have to be constantly shifting so as to comply with the regulations.

Mr. Campbell (London) suggested that it would be well if Mr. Munce gave them a paper at the next Congress, for he had been the candid critic on that and

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* See Vol. XIX., p. 47, for an account of this.

† I find since that it is much less.—J. M.

other occasions. The crux of this question was finance. They had to repay their loans in a much too limited period, with the result that they had to charge about 7s. per week for the houses. Some 4s. 6d. of that was taken up in the repayment of principal and interest, so that the poor working man with 20s. to 30s. a week had to pay about 4s. 6d. a week for the creation of an asset for posterity. If this serious financial obstruction could be removed, and if they could borrow money at a less rate of interest, a great many of the evils from which they suffered could be remedied. He did not see why the great savings of the working classes in the Post Office Savings Bank, which amounted to many millions of money, for which they only got $2\frac{1}{2}$ per cent., could not be loaned to the local authorities, on behalf of these same depositors, at the rate of 3 to $3\frac{1}{4}$ per cent. If that could be done, and a longer term given for repayment, the financial difficulty would be removed. A good deal had been said about these one-room houses, and he happened to know both the blessings and the curse of such houses. He was under the Corporation of Edinburgh 15 or 20 years ago, and no place was so cursed with the one room dwellings as they then were. But in the hands of the Corporation of Edinburgh many of the evils of the one-room house had been removed by the restriction that persons inhabiting them should be only single persons, or a man and his wife, and when the tenants outgrew the cubic space per head they must remove to other premises. If the one-room house was controlled in that way then it would be an undoubted boon to the community. Reference had been made to the size of the room, and that was a very important question. The London County Council set a splendid example by laying it down that a room should not be considered a room unless it was 12 feet by 12 feet, whereas if they went to that much-lauded place, Richmond, they found rooms 10 feet by 8 feet. There ought to be a standard of what a room was, and he supposed that Glasgow would be quite as good as London with regard to space. He was glad to say that the houses for which he was responsible in a building scheme to the extent of about £60,000 for his local authority, they were able to let at 1s. 4d. per week per 100 superficial feet. That was the standard he adopted, and if they reduced all the various descriptions of standards to that of 100 superficial feet of actual available habitable space they would be able to make a true comparison.

Mr. Armstrong, in reply, said he thoroughly agreed that such a state of things as five persons living in one room should not exist. They should have some responsibility for morality amongst the people, and ought not to have five or six people sleeping in one room. Dr. Sykes had objected to the localization scheme, because he felt that the land might become unsuitable for building working-class dwellings chiefly by having factories erected in the immediate neighbourhood. He failed to see that factories erected on modern lines were any detriment to working-class dwellings if the dwellings were surrounded by gardens and proper air space. If they had factories not built according to modern

standards, not ventilated according to modern methods, and not carried on in a proper way, there might be an objection. With regard to the 400 feet, unless they had some means of providing for tenants dishoused by some such scheme and buying land cheaply and developing it at once, they would simply have what had gone on before. The speculative builder would buy land and get the highest rent he could, and instead of a three-roomed house being 2s. 6d. a week it would be run up to 5s. and 6s., or even more. They must do something, and he suggested that after they left that meeting, those interested would still further consider this point. If they had one-room houses they wanted to start by teaching the children to live respectable lives; they must teach them hygiene and bring the thing home to them. After that they had to teach the fathers and mothers to be sober. If not, what examples were the children to have if they were to live and grow up in one room? to say nothing about the amount of air they breathed. He believed the standard in London was 96 square feet for sleeping rooms and 144 feet for living rooms. The 400 cubic feet he referred to was for sleeping rooms, where people spent about a third of the day, while in addition in the living room the door and windows were generally opened.

Dr. J. F. J. Sykes moved, "That this Section recommends the Council of The Sanitary Institute to represent to the Local Government Boards of England and Scotland that the definition of overcrowding, as 400 cubic feet per adult person and half the amount per child in sleeping rooms, is required in the interest of the public health." He thought that was very reasonable. The Local Government Board of England now required 500 cubic feet in underground bakehouses where workmen worked by artificial light, and surely where adults lived they should require 400 feet, for the probability was that it was worse for a person sleeping to have less air space than in the room he lived. They knew that Glasgow had adopted in their by-laws the 400 cubic feet as the minimum, and Glasgow was an extremely appropriate city to set an example to the rest of Great Britain in the matter of cubic space.

This recommendation was carried.

COTTAGES FOR AGRICULTURAL LABOURERS.

By Miss CONSTANCE COCHRANE.
(Member.)

ABSTRACT.

THANKS to the slow, but probably all the surer, growth of public opinion, the all-important question of cottages for agricultural labourers is receiving the attention of many thoughtful persons.

The scarcity of suitable and sanitary cottages, often of any at all, is no longer a matter of uncertainty, and can be proved by a perusal of the reports of numerous Councils and Associations, especially of the evidence in the possession of the Rural Housing and Sanitation Association.

In view of these facts, how are cottages to be provided? and of what kind should they be?

To answer the last question first. No labourer's cottage should be built with less than three bed-rooms, as the two bed-room cottage already furnishes by far the larger proportion of the existing supply, and is the unavoidable cause both of overcrowding, and of the herding together in the same room of persons of both sexes and of all ages.

The two principal bed-rooms should contain not less than 1,000 feet of cubic capacity each; 300 cubic feet of space being the minimum health allowance for an adult or child over ten, and 150 for children under ten. There should also be a fireplace in at least one bedroom.

There appears no sufficient reason why stairs should be enclosed between walls, instead of rising out of the kitchen or scullery.

Two living-rooms are better than one, but one large room is very preferable to two small ones, and the scullery should be of a size which would make it impossible for the family to live in it.

All the windows in the house, including one in the pantry, should be made to open, and should extend to the ceiling.

The material used in building is less important, provided the soil is dry, the foundations good, and the walls rain-proof, and with damp

courses. And it would be well to encourage building with whatever material can be obtained most cheaply in the neighbourhood; as is done, for instance, at Winterslow, near Salisbury, where a good detached cottage with three bed-rooms can be built for £115 out of the chalk of the country.

It has been well said by Mr. Wilson Fox, that the important matter is not the length of time for which a cottage shall last, but that a cottage which is built to last fifty years shall not be allowed to remain in occupation for 100 years.

Many of the old mud cottages are more warm and comfortable than some of the modern brick ones.

A matter of far more importance than the materials used in building is the provision of sufficient open space round the cottage. According to Dr. Vivian Poore, a fifth of an acre is the minimum of garden ground upon which household slops, sewage, etc., can be disposed of in a sanitary manner, so as to obviate the necessity for drains.

If from an acre to three acres of land were attached to a cottage, its letting value would be increased, and such a system would encourage one of the most satisfactory methods of working small holdings.

As, for instance, when a father is a day labourer or a blacksmith, and his son or brother works his land, and the profits are divided; or when a labourer gradually increases his holding and gives up regular employment, working the greater part of his time on his own or on his neighbour's land, and coming to the assistance of the farmer when hands are scarce, or when there is draining, etc., to be done. Such a man would probably have one or two sons employed in labouring work and bringing in regular wages.

In many districts the better off of the labourers would be glad to build their own houses, if they could purchase the land at reasonable prices, or could lease it for 99 years, or from a syndicate; or if there were some land court from which they could borrow money at low interest, and pay off in instalments.

And in nearly every village, certainly in all the larger ones, there are tradesmen and others who would be glad to pay commercial rents for good houses. These might be provided under Part 3 of the Housing of the Working Classes Act, 1890.

Mr. E. O. Fordham, of the Cambs. County Council, advocates the appropriation of the land tax for cottage building; and Mr. Bolton King would like to see cottages provided more or less out of the rates.

Another suggestion is that sanitary authorities should be empowered

to purchase cottages which are capable of being made fit for human habitation without incurring loss on the rates, and to let them to labourers.

Thank-offerings, and memorials to the departed, might oftener take the form of a cottage or a few almshouses, which latter are sadly needed at the present time, as the homes of the widows and the aged are constantly required for the accommodation of agricultural labourers.

Miss Paterson (Glasgow) said that if one went from the town to the country they found a similar state of things. She had had the very pleasant experience of living in a tent in a very beautiful part of Scotland, and it was interesting to see the concern all the people around took in them as to their catching colds. There was a little cottage near, with windows either side of the kitchen, and they had two bed-places built into the kitchen. The windows were absolutely fixed, and it was impossible to open them. In the morning, afternoon, and evening the air of the room was quite as bad as one met with in an ordinary town slum dwelling. It was a curious and interesting comment on the condition of the cottages round about that in three of them there were two bed-ridden people and two "innocents."

Mr. J. G. D. Armstrong (Sheffield) felt that it boded well for the improvement of those dwellings that ladies were taking an interest in them. In a great many cases, particularly in the rural districts, more good could be done by ladies than by men. In their large centres they had now what were known as public health lady visitors, who were doing work which was very important in every way. They were educating the people to keep their houses clean; and in many cases where the houses were in an insanitary condition, owing to the visits of these ladies the houses were becoming fit to live in.

THE CONSTRUCTION OF HOSPITALS.

By ALEX. CULLEN, F.R.I.B.A.

IN treating the subject of hospital construction perhaps it would be well for an architect to confine himself to the constructive side of the question, and leave the matter of administration to the care of the experienced physician. I shall, therefore, proceed at once to consider the practical elements embraced in the erection of a modern hospital.

As you are aware there are various descriptions of hospitals, each intended to serve some specific purpose, and these may be roughly grouped into three classes:

(1) *General Hospitals* for the treatment of surgical and medical cases.

(2) *Special Hospitals* where certain diseases are treated, as cancer; or it may be for diseases of the skin, the eye, or the ear.

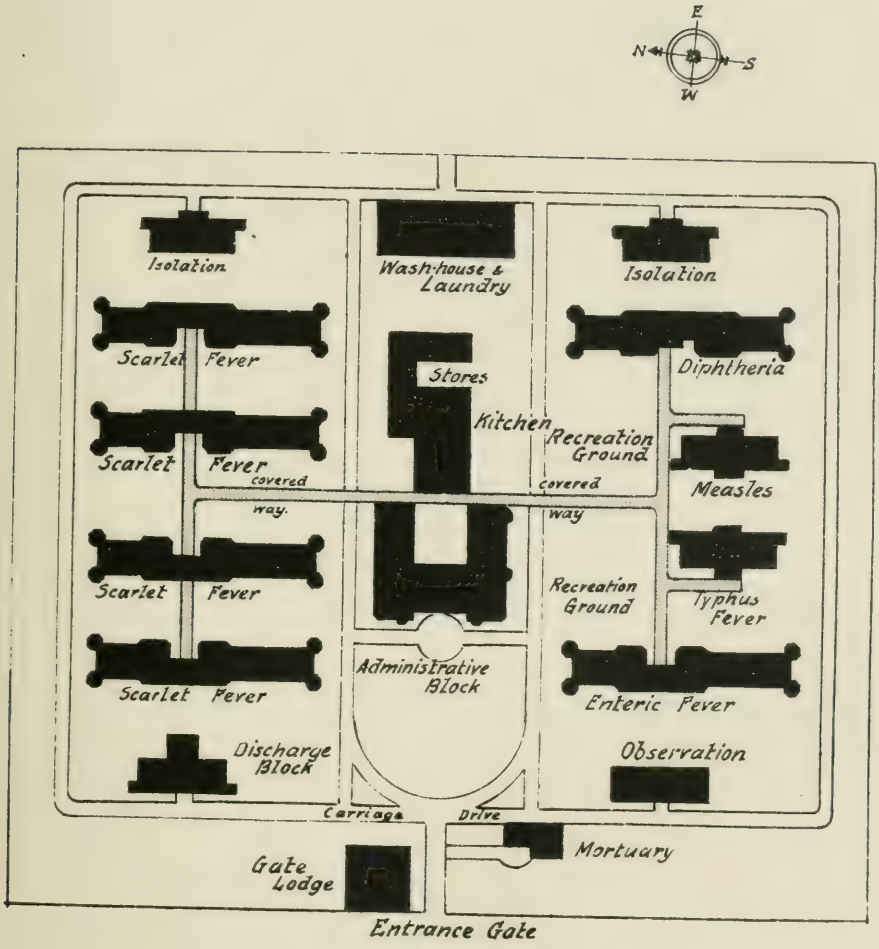
(3) *Hospitals for Infectious Diseases* in which cases of an infectious nature such as scarlet and enteric fevers, measles and diphtheria, or perhaps smallpox, are isolated and treated, the aim being to prevent the spread of the particular disease among the community.

Of the three kinds of hospitals just mentioned, that for the reception and treatment of cases of infectious disease is, I assume, the one in which the interest of The Sanitary Institute is mostly centred. While it is this class of hospital that I propose more particularly to deal with, yet my remarks will, in a number of details, apply to hospitals of all kinds; for in each type there are involved the same general principles of sanitation.

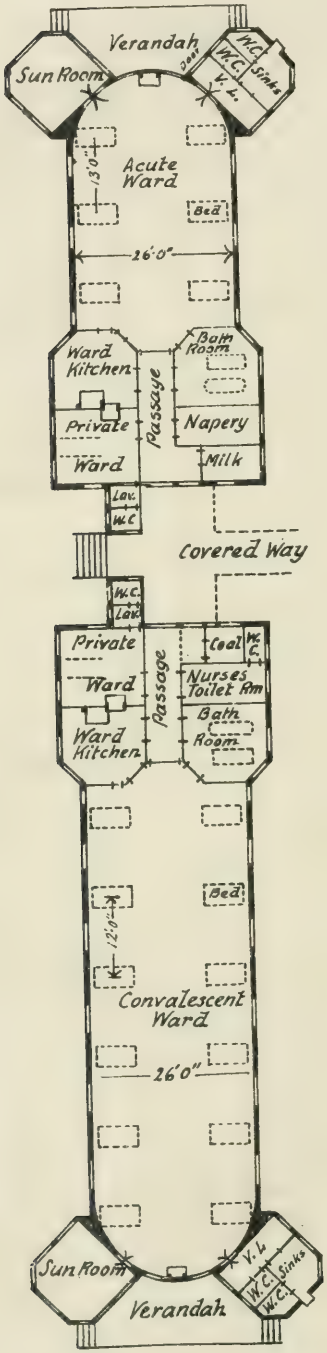
I think it well, however, not to attempt in a short paper a minute and detailed description of the many and varied points needful to be observed in the planning and construction of a modern hospital for infectious diseases, but rather to sketch in outline the erection of such a building from the selection of a site to the furnishing of the wards.

Suppose, then, the sanitary authorities of a town of about 100,000 of a population have, after considerable pressure by the Local Government Board, resolved on the erection of a hospital for the treatment of cases of an infectious nature.

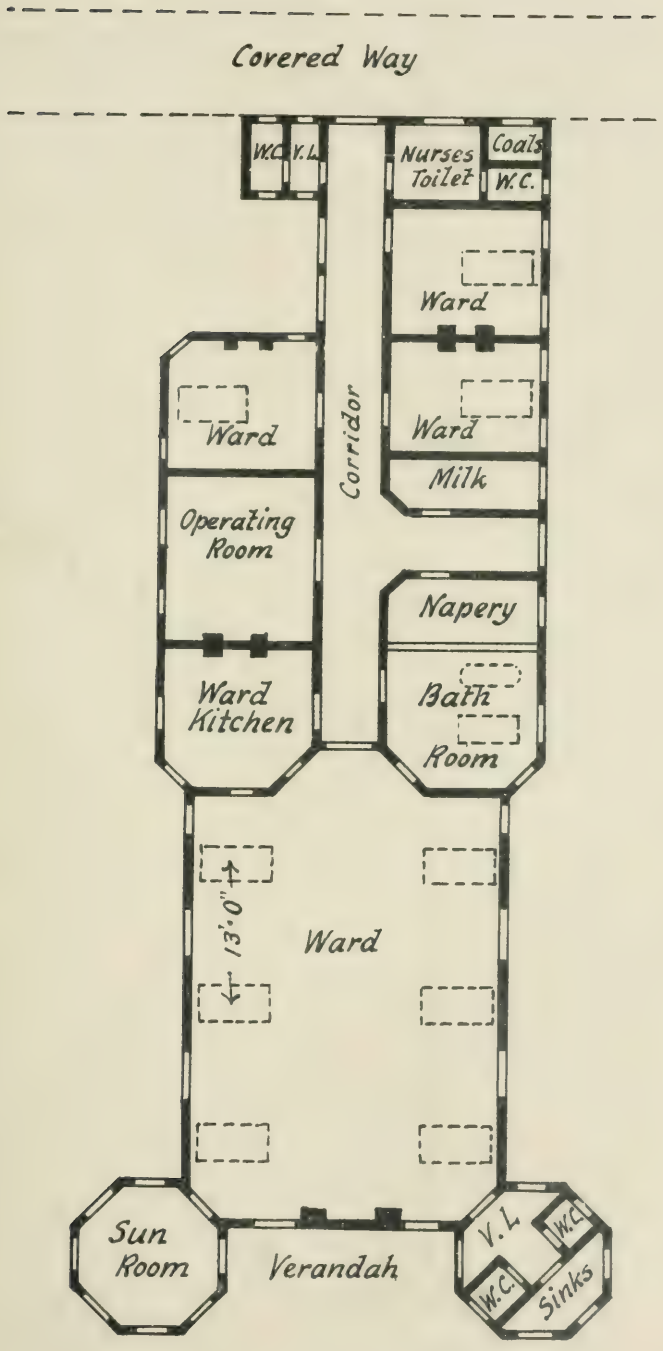
The next question that comes to be considered is the number of beds


E
N
S
W
Isolation
Wash-house & Laundry
Isolation
Scarlet Fever
Stores
Diphtheria
Kitchen
Recreation Ground
Scarlet Fever
Covered way.
Covered way
Measles
Scarlet Fever
Recreation Ground
Typhus Fever
Administrative Block
Scarlet Fever
Enteric Fever
Discharge Block
Observation
Carriage Drive
Mortuary
Gate Lodge
Entrance Gate

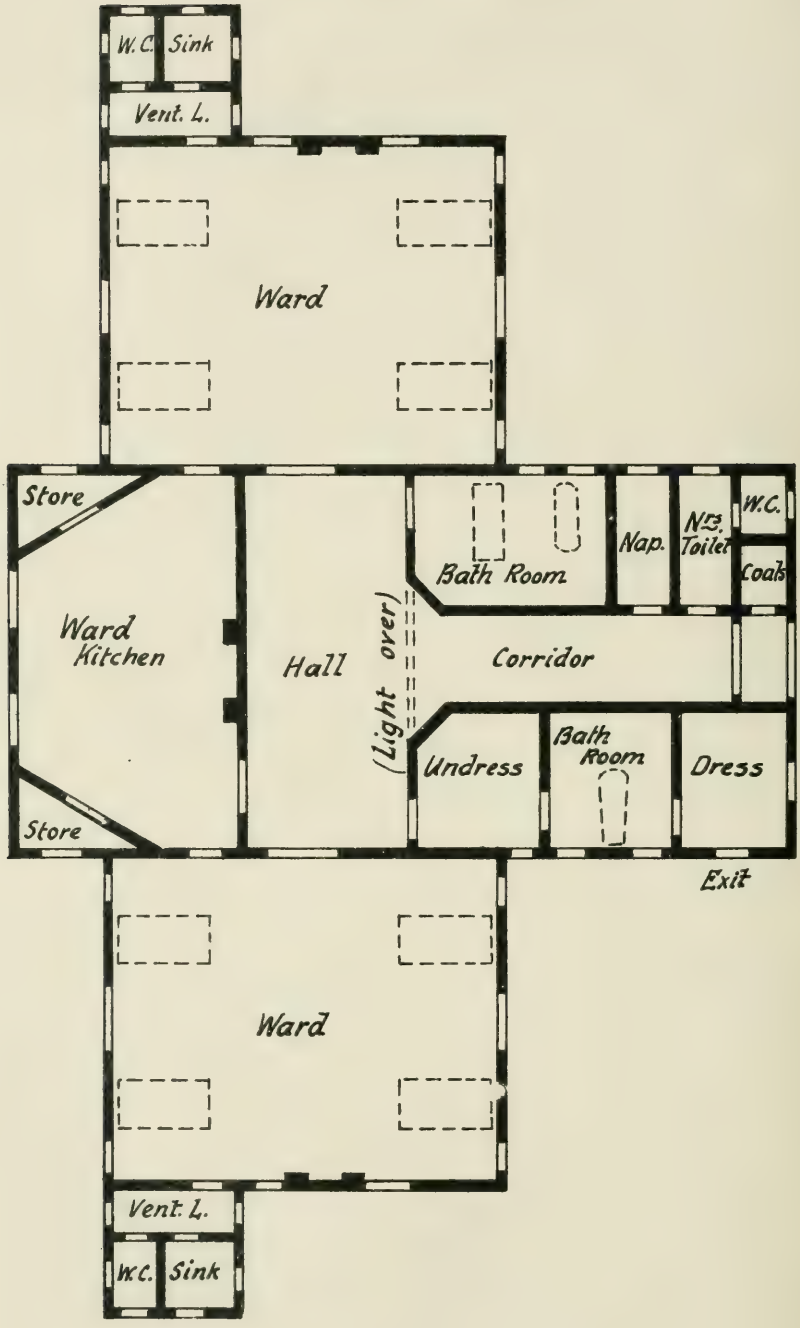
BLOCK PLAN



SCARLET FEVER PAVILIONS



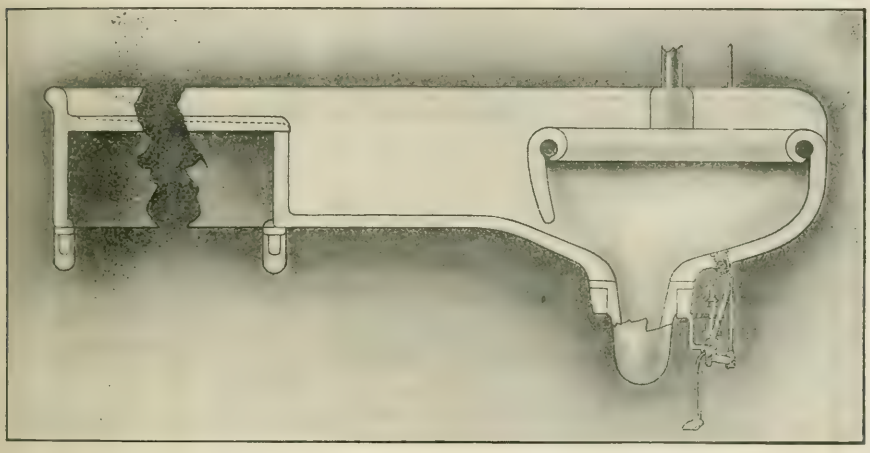
DIPHTHERIA BLOCK



DISCHARGE BLOCK

for which provision should be made. It is customary to provide one bed for every thousand inhabitants within the area that the particular hospital has to serve. While this may be sufficient under ordinary circumstances, it is always well to provide accommodation on an ample scale.

In order, therefore, to meet emergencies in times of exceptional epidemics, which are observed to occur at intervals of three, four, or five years, accommodation should be provided to the extent of three beds for every 2,000 of the population. In this particular case we shall assume that the hospital is to be planned on the higher standard and to accommodate 150 patients.



Doulton's combined mackintosh bed pan and scalding sink.

In the site of a modern hospital for infectious diseases an area of one acre for every twenty beds is considered sufficient, but in the present instance we are dealing with a model town council, and they have the wisdom to foresee the possibilities of a future extension of the buildings, and decide on acquiring ten acres of land.

This question of site is a very important one, and it is well that the medical officer should be consulted on the matter, and in all likelihood will direct his attention to its physical conditions, such as aspect, prospect, and will enquire into the nature and extent of the sickness and the rate of mortality in the particular district.

After satisfying himself on these points, the medical officer recommends a site. It is situated in the open country yet convenient to the district

the hospital has to serve, so that patients have to be driven only a short distance. The ground slopes gently towards the south, and it is well sheltered by trees, both on the north and on the east sides. The soil is of a dry loamy nature, and is well under-drained. The water level in the subsoil is fairly deep and permanent, and there are no objectionable conditions near that might lead to the pollution of the soil. There is an abundant supply of water for the needs of the hospital, and a good drainage outlet can be obtained.

The cost of the land will depend to a considerable extent on the situation, but supposing there are exceptional circumstances to be taken into account a fair value would be from £250 to £350 per acre.

The site having been fixed on, the next matter that comes under consideration is the nature and number of the diseases to be treated. On this question the medical officer will be guided by the statistics of the infectious diseases prevalent in the district more especially during epidemics. His experience also in the practical working of a hospital will indicate the extent of the administrative offices necessary for the effective management.

Suppose then the following programme of classification with explanatory notes has been prepared:—

Scarlet Fever	100 beds.
Enteric Fever	20 „
Diphtheria	12 „
Measles	10 „
Typhus Fever	8 „
Total ...	150 beds.

Scarlet Fever.—The accommodation for cases of scarlet fever to consist of two observation or probationary wards of two beds each. In these wards will be received cases considered to be scarlet fever, but in which the diagnosis was doubtful. Here such cases will be detained until the nature of the illness has declared itself.

The ordinary pavilions to provide for 72 beds divided into wards of 12 beds for females and young children and wards of 6 beds for male adults. Attached to each ward there is to be a one bed ward intended for special cases or for private patients.

Isolation Block.—Of two wards of four beds each for the isolation of cases of double infection, such as scarlet fever with diphtheria, scarlet fever with whooping cough, or scarlet fever with measles.

Discharge Block.—Divided into two wards of four beds each. To this

block would be sent the patients believed to be free from infection. Here they would receive special bathing, and be under careful observation for a few days prior to their discharge. These precautions are intended to avoid return cases, that is, cases which occasionally occur in the households to which patients have returned from the hospital.

Enteric Fever.—The accommodation for enteric fever patients to consist of two wards, one for twelve beds the other for six beds, and attached to each a one-bed separation ward.

Diphtheria.—A block consisting of a general ward for eight beds, and four single-bed wards, besides a small room, well-lighted from the roof, where operations may be conducted. In the one-bed wards are to be special steam connections to provide a moist atmosphere for critical cases.

Measles.—A block having a six and a four-bed ward intended for the isolation of cases occurring under circumstances involving special risk of the spread of the disease.

Typhus Fever.—A block divided into two wards of four beds each. Although cases of typhus fever are not of frequent occurrence, still it is better to provide for an emergency. This block when not in use for its special purpose would be available as convalescent wards for enteric fever patients when that disease is prevalent.

Administrative Block.—This building should be located about the centre of the group, and convenient to the entrance gate, so that anyone calling on business, or vans delivering stores, would not go near the wards where patients are being treated. Accommodation should be provided sufficient to cope with any emergency that may arise, and the possibility of a future extension should be kept in view.

In a hospital for 150 patients there will likely be a staff consisting of a medical superintendent and an assistant, a matron, 39 nurses, 15 female servants, such as ward-maids, laundry-maids, kitchen servants, and housemaids; besides four male attendants.

The ground floor on one side of the block should be devoted to the medical officer, and the other side to the matron and nurses. On the first floor should be the sleeping accommodation for the matron and nurses, each nurse to have a separate room about 12 ft. by 9ft. Ample bathrooms and lavatories should also be provided. Special precautions to be taken to have the rooms for the night nurses in an undisturbed wing of the building.

The female servants to have their sleeping apartments on the second floor, but entered by a separate stair from that to the nurses' quarters.

In the rear would be the kitchen department. The kitchen should be a large apartment well lighted from the roof and thoroughly ventilated. Attached to the kitchen are to be a wash-up scullery, a vegetable scullery, and a service room with a recess for food trolleys; besides the necessary stores and larders. The milk store should have an intervening lobby for scalding milk pans.

Laundry.—The laundry to be removed as far as possible from the infected buildings, with which it should have no connection by covered ways. This block may with advantage be divided into two sections, one for male and the other for female labour. In the first section will be placed, perhaps in the basement, the steam boilers, coal store, fire pumps, engine room, workshop, destructor for destroying the hospital garbage, and a steam disinfector sufficiently large to receive bedding or other large articles.

In the second section would be the washhouse and ironing room. The ironing may be common to the clothes of the staff and the patients, but there should be separate washhouses for the soiled linen of the staff. The receiving and discharge rooms should also be separate.

The drying chamber would be convenient if placed between the washhouse and ironing room, the hot air being driven into this chamber by a fan; and a fan will also be required for extracting the steam from the washhouse.

As a laundry is the place in a hospital where infected articles are gathered, special precautions should be taken. The soiled articles from the wards should be placed in steeping tanks and the tanks classified for the different diseases.

Entrance Lodge.—This building to be placed near the entrance gate where the head male servant would reside, his wife acting as gate-keeper. Attached to the gate lodge there is to be a waiting room for friends of patients. The accommodation for the male servants to be on the upper floor of the lodge, but with a separate entrance.

Between the entrance gate and the wards there should be a waiting room for ambulance nurses, and fitted up with a hot plate and shelves for blankets.

Mortuary.—This building to consist of a mortuary and post-mortem room, a small laboratory, and a room for friends to view the body; the body, instead of being placed on a slab in the usual manner, will be laid on a bed, and the bed can be wheeled into the viewing room.

In compiling the programme I assume that the medical officer has

been associated with the architect, and the architect will be wise if he continues this association until the general principles of the scheme are fully matured; after which the medical officer will be wise to leave the carrying out of the details to the practical architect.

The architect in preparing the plans keeps closely to the programme of classification, and connected therewith the first point to receive this attention is the ward; for the form of a ward governs to a considerable extent the planning of a hospital.

It may be taken as an axiom that where land space permits the wards are better if contained only on one floor; the pavilions are, therefore, planned one storey in height. The distribution of the several buildings on the site is a matter of the utmost importance, in order that each ward may obtain the fullest amount of sunshine.

The longitudinal axes of the several blocks are, therefore, placed north and south on the site, or, perhaps, a few degrees east of south and west of north. By this arrangement sunshine on three sides of the wards can be obtained.

The plans are based on this principle with the result that the wards are arranged on parallel lines, as shown on the block plan to which I wish to direct your attention. The space between the pavilions is 40 feet, and there is a zone of 50 feet between the buildings occupied by infected persons or things and the hospital boundary.

The communication between the several parts of the hospital is direct, and for the comfort of the staff the paths are roofed over but open at the sides.

The floor area and cubic space of a ward have to be regulated to a considerable extent by a standard set up by the Local Government Board. The area is given at 144 square feet and the cubic space at 2,000 feet per patient. These units, however, need not be strictly applied in every case. For instance, is it not reasonable to suppose that the cubic space in an acute ward should be more than in a convalescent ward? Besides, medical authorities recommend that in cases of enteric fever and diphtheria the standard should be increased.

The width of a ward will regulate the other dimensions, but it should be noted that floor area is of more value than additional height. An ample width should be allowed for tables and fire stoves in the centre of the ward, and also to permit of the bed being kept about one foot from the wall.

Taking all these points into consideration, it seems that 26 feet is a suitable width and 13 feet a convenient height for a ward. The width and

the height having been fixed, the only question that now remains is the distance between the beds, and this distance will determine the cubic capacity of the ward.

In the plans under consideration there is provided 12 feet of wall space per bed for the scarlet fever convalescent wards, while in the scarlet fever acute wards and in the wards for diphtheria and enteric fever the distance is 13 feet. The cubic space in the one instance is 2,028 feet and in the other 2,197 feet.

The window space in a ward will be governed by the floor area and cubic contents. Experience has shown that in this country one square foot of glass is required for every 60 cubic feet of space, but where verandahs overhang windows or where wards are lighted only from one side the glass area should be increased.

The bathroom is at the entrance end of the ward and is provided with two baths, one of the usual size of 6 ft. long and a smaller one for children. The baths will be rapidly filled and emptied.

The sanitary appliances are placed in a turret at one of the distant angles of the ward, and are separate therefrom by a well-lighted and ventilated lobby. Here will be two water closets and a sink room. In this room will be fitted up a combined arrangement of sinks divided into three sections:—the first consisting of a grooved slope about 3 ft. 6 in. long, for the cleansing of mackintosh sheets, the second of a scalding sink for washing urine bottles, and the third a sink for flushing bed pans and which will serve also as a slop sink. In the sink room there is also a small cupboard for the retention of bed pans that have to be examined by the doctor.

At the other angle of the ward facing the south-east is a sun room, which is divided from the ward by folding doors, so that patients unable to leave their beds can be wheeled into the room. Between the two angle turrets is a verandah for the use of patients who are able to move about.

The one bed ward is near the entrance, and has its own sanitary conveniences.

The ward kitchen is placed between the two wards, and has an inspection window into each. In this room will be a small fire range or steam closet for keeping food warm; besides a wash-up sink and a dresser. Near the ward kitchen is a nurses' toilet room and W.C., a linen store and a milk larder.

Having given a general description of the plans, let me now direct your attention to the construction, finish, and equipment of the hospital. The essential requirements are ample light and ventilation, no sharp angles

or mouldings to catch dust, wall surface and floors of a hard non-absorbent nature, also as little woodwork as possible; the whole so planned and constructed as to require a minimum of care or repairs. The method of construction and finish of the plans now shown is intended to accomplish this result.

The foundations will be of Portland cement concrete and the damp proof course of Caithness pavement 2 in. thick. The area under all floors will be covered with a layer of asphalte. The walls will be built of brick 16 in. thick, consisting of a 9 in. outer face, a 2½ in. hollow space, and a 4½ in. inner facing tied together with galvanised iron straps.

The ward floors will be of teak, and the surface shellacked and wax-polished. The skirting will be of the same materials as the floor, and hollowed or coved to a 3 in. radius.

The corridors and sanitary turrets will be paved with marble terazzo, while the bath rooms will be paved with indiarubber interlocking tiles.

The windows in the wards will have the lower part hung as an ordinary window and the top hinged to open inwards. There will be no other projections to harbour dust, and all the facings will be rounded and keyed to the plaster. The glazing will be of polished plate-glass, as this is preferable to double glazing with sheet-glass, for in course of time the space gets filled with dust.

The doors will have flush panels and the plainest of furniture. The standards on which the doors are hung will be checked for the doors and the wall plaster, so that no cheeks or facings will be required.

The plumbing will be executed on the most approved principle. The pipes and fittings will be exposed, and all traps will be ventilated to the roof.

The walls of bath-rooms, sanitary turrets, and corridors will be lined to a height of 5 ft. with white enamelled tiles. The buildings will be lighted by electricity, and there will be telephonic communication through the several blocks.

Heating and Ventilation.—The boilers for raising steam will be placed in the laundry block, the steam being conveyed in subways to a central point in each block. The steam will be led into calorifiers, of which there will be two, one for the supply of hot water to baths and sinks, and the other for the heating system.

Between the beds will be hot-water radiators, with high legs and baffle plates on front and fitted with a ventilating register, through which the fresh air will be introduced. The radiators will be fitted with valves so that the temperature in each ward can be regulated.

The heating power will be sufficient to maintain a uniform temperature of 62° in the wards and 57° in the passage.

In addition to the hot-water radiators there will be open fires. The foul air will be extracted by special flues in the walls and by shafts from the ceilings, terminating at the ridge with air pump ventilators. Each outlet will be fitted with a regulating valve.

Ward Furniture.—The beds will be 6 ft. 3 in. by 3 ft., and about 2 ft. 6 in. high, as at that height a patient can be handled more easily. The feet will be shod with wood so as not to damage the floors. The bed will be high at the head and have three horizontal bars by which a patient may help himself in many ways.

By each bed side will be a small table of enamelled iron with plate-glass top. Writing tables for the use of nurses will be required for the making up of charts. The chairs will be of plain hard wood, as no upholstered furniture is permissible in a ward.

A wheel chair with rubber tyres will be provided for conveying patients to the bath room. Screens in three leaves, each about 5 ft. 6 in. by 2ft. 4 in., will be provided to draw round the bed during special examination or dressing.

Bed pans and urine bottles are better made of earthenware than enamelled iron, as in time the enamel chips off.

And now, I have finished, and no one is more conscious than myself of the number of important points in hospital construction on which I have not touched; but I have tried in the short time at my disposal to give some idea of what I conceive to be an ideal hospital for infectious diseases.

Mr. Field (Eastbourne) asked if the convalescent ward shown on the plan was intended to be used by the same patients who had been in the acute ward. It seemed to him it would be rather an expensive mode of construction, and also perhaps somewhat dangerous to the patients. Were the covered corridors intended to be enclosed or open? If they were enclosed he would say it would be a means of conveying infection or enclosing infection, and would connect the wards in an unsatisfactory manner. If, on the other hand, they were not enclosed, and were simply roofed, it would be a very draughty place for patients to be moved from one ward to another.

Mr. Campbell (London) said there was no doubt the arrangements shown on the side plan, and the detail upon the working plan, was, on the whole, a very good one; it was approaching the ideal, and therefore would no doubt be

attended by very considerable cost in construction. As to the general site plan he did not know whether it was the plan of a building actually constructed or not, but if they submitted it to the Local Government Board of England there would be some little criticism to offer as regarded the particular direction the ward blocks followed. They seemed to look east and west, and the Local Government Board would insist on them being inclined to a more north-westerly and south-easterly aspect. As to the larger drawing, he noticed, there were only 18 beds shown on the diagram, plus the two private wards. It was an ideal arrangement, but considerations of cost prevailed in working out these things. Mr. Cullen showed a separate administrative arrangement for each side—that was 12 beds in one and 6 in another; only 18 in all. That would, he thought, be prohibitive on the score of cost, except for the very richest communities. He liked the arrangement very much with regard to the sun room and also the verandahs. It was a much more commendable arrangement of planning than the closet buildings at the end which were so commonly adopted. He would like to know Mr. Cullen's estimate per bed of an institution of that kind. A few years ago they were able to put such a building up at about £250 per bed, but recently they had run up to as much as £500 and £600 per bed, and in one case to as much as £750 per bed. When they ran up the cost like that these luxurious institutions practically became prohibitive. It was very necessary to place the discharge block so as to prevent return cases, and he questioned very much the expediency of designing a discharge block in such close proximity to the general infected area. What they had done in East Ham was to have the discharge block altogether away from the infected area of the hospital. They had bought an old country mansion and utilised that for the convalescent home, so that the patients who had just left the scarlet fever wards should have about ten days' detention and probation before they were finally discharged and entirely cured. By that means the likelihood of return cases was greatly diminished. If the Local Government Board would insist on a separate discharge block a quarter of a mile away, even if it were only of corrugated iron, the children would be able to run about, and that would greatly reduce the likelihood of return cases.

MR. LAMBIE (Lanarkshire) said they had had experience of Mr. Cullen, and both as to cost and utility he believed that the Middle Ward Hospital at Motherwell stood unique in that country. There were some improvements in the plans before them. As to cost, the Motherwell Hospital was one of the cheapest and best to be found anywhere. Mr. Campbell had spoken about cost, and had also suggested having the discharge block about a quarter of a mile away; but he did not see how that was going to lessen the cost. As to the risk of infection, there was not much in that, as was proved by the hospital which had been erected. In Motherwell they knew the cost, and they knew also the benefit the hospital had been to the community. They had no administration block, because they held

that it was for those who were struck down with disease that hospitals should be erected, and there should be no palatial rooms for the administrators.

Mr. A. G. Wallis (Glasgow) said that Mr. Saxon Snell had been unfortunately obliged to go away, but had asked him to read some comments he had written, as follows:—"Mr. Cullen advises the provision of the sinks in conjunction with the patients' w.c.'s. I think the more modern practice is to keep them in a separate compartment with separate entrances from the ward. I have not had the advantage of seeing the plan of the ward referred to, but if as I suppose the sun room is of the same area as the sanitary annexe, it will be rather small. The whole end of the ward for a depth of 12 or 15 feet, and with both angles canted, would provide a much larger and better lighted room. Mr. Cullen suggests ordinary sash windows with hoppers at the top. That is the usual practice, but we may hope that in the near future some better form of window with fewer internal angles and grooves may be adopted. It would be quite possible to construct windows with the glass flush with the sash or casement frames. My personal preference is for casements carried down to within one foot of the floor. Doors can now be made absolutely flush both sides and veneered with wide hard wood. Referring to the heating arrangements, modern hospital practice has got rather beyond the use of calorifiers for each separate block. It is possible and much better to carry the pipes from one central station. One is always surprised to hear that separate radiators with all their dust-collecting properties are advocated for wards. A couple of two-inch pipes carried along the walls is a much simpler arrangement. The valves can be kept outside the wards. Ward furniture can no doubt be shod with wood, but india-rubber is better."

Mr. Cullen, in reply, said it was intended to remove the patients from the acute ward to the convalescent ward, and they had in his experience found no difficulty in so doing. He proposed that the corridors should only be roofed over. As to the position of the blocks, he did not see why the Local Government Board should not approve, because it was thought that the ideal position of a fever pavilion was that it should be a little bit east of south, and that was the position here. He saw nothing objectionable about the discharge block being where it was, because it was part of the hospital. The discharge block was entirely disconnected, and he saw no reason why patients should not be brought there and be under the care of the medical superintendent until discharged. He was aware that it was within the infected zone, but so were the other buildings. As to price, he saw nothing to prevent a hospital of that nature being built in a country district at from £450 to £500 a bed. A few years ago a hospital without the discharge block and isolation block, but otherwise of the same type, was built considerably cheaper, and the cost of Motherwell Hospital was about £400 per bed. He appreciated the criticism of Mr.

Saxon Snell very much, but he was speaking of an entirely different type of hospital from this. Mr. Snell's remarks applied more directly to a hospital in a city, but this one was intended to be built in the country. He did intend to put the sink into the same annexe as the water-closets, and he thought it proper to do so.

MR. A. G. WALLIS: Mr. Snell says it is rather small.

MR. A. CULLEN said that was so, but if it had been made larger it would take away the sun from the wards, and it was better to have a small sun room than none at all. As to the windows, there were no angles or grooves. Everything was rounded and flush. With regard to the radiators it was rather objectionable to have pipes or radiators of any kind, but of the two he thought it better to have perpendicular radiators than horizontal lines of pipes.

CONGRESS AT GLASGOW.

SECTION III.

PHYSICS, CHEMISTRY, AND BIOLOGY.

ON THE HYGIENIC SIGNIFICANCE OF SULPHUR IN COAL GAS.

By S. RIDEAL, D.Sc., F.I.C.
(Fellow.)

IN 1903 I found that London external air was frequently more vitiated with sulphur than the air of rooms in which gas was burning. Thus, the external air on February 18th, 11.0 a.m. to 2 p.m., contained ·0193 grains *S per 100 cubic feet of air; but from 3.0 p.m. to 6 p.m., in a closed room 8·5 cubic metres, with 1 gas jet, it fell to ·0177. Similarly on February 25th, the external air from 10 a.m. to 3.0 p.m., gave ·017, and from 3.30 p.m. to 8.30 p.m., in a closed room 8·5 cm., with 1 gas jet, only ·001 was obtained. A simultaneous experiment on March 23rd, 10 a.m. to 5.45 p.m., gave ·0081 grn. S in the outside air, whilst in a closed room, with 1 gas jet, the quantity of sulphur present was only ·0046 grn. Even with 2 gas jets in a closed room of 32·5 cubic metres capacity, the sulphur was only raised from ·0038 to ·0099.

These results warranted a further study of the subject, and a large number of experiments this winter have been reported to the Board of Trade Committee in which coal gas purified by lime only and by lime and oxide, and supplied by the South Metropolitan Gas Co., was employed.

As a general result of these experiments I found that in an ordinary room with plastered walls, a limewashed ceiling, and gas burning at varying rates

* Grains of sulphur per 100 cubic feet × 16 = vols. per million of sulphur as SO_2.

Note.—The Proceedings of the Section commenced with an Address by Professor Frank Clowes, D.Sc., F.I.C., F.C.S. (*see page* 278).

up to 5 cubic feet per hour for many hours, in two rooms of about 1,000 cubic feet capacity, oxide gas gave ·0035 grn. S as SO_2, and ·0126 total S; limed gas gave ·0024 grn. S as SO_2, and ·0051 total S.; whilst external London air gave ·0077 grn. S as SO_2, and ·0157 total S, per 100 cubic feet.

These results show that:—

1. The average sulphur in the air is higher than in either of the two rooms, when either gas is burned in an ordinary way.

2. The sulphurous acid is also higher in the outside air than in the two rooms.

3. There is more sulphurous acid proportionately in the outside air than in the air contaminated by either gas.

4. That the gas purified by oxide only gives a slight increase of the sulphurous acid and sulphur in the rooms over the lime-purified gas, but does not reach the quantity in the outside air.

5. The total sulphur in the outside air varied from a minimum of ·0082 grn. to a maximum of ·0235. Country air contains about one-fifteenth of this amount of sulphur. The maximum figure I have found for outside air during fog at St. George's Hospital in 1892 was ·12 grains per 100 cubic feet, or about 2 vols. per million.

The total sulphur and sulphurous acid content of the air in closed rooms where known volumes of the two gases have been burnt, has thus been determined simultaneously with that of the outside air, and in no instance has the theoretical increase of sulphur been obtained from the air of the rooms. Taking the ordinary gas as containing ten grains of sulphur per 100 cubic feet, a burner passing 5 cubic feet per hour would theoretically increase the total sulphur in a closed room of 1,000 cubic feet capacity by 0·05 grain per 100 cubic feet of air per hour less the amount lost by ventilation. As a fact, the quantities of total sulphur and SO_2 obtained under these conditions are usually considerably less than that of the outer air. The maximum increase obtained was ·01 grain S per 100 cubic feet on December 7th, after 54 feet of the lime-purified gas had been burnt in the closed room during ten hours, which is about $\frac{1}{100}$th part of the sulphur evolved in the room.

This loss of sulphur was proved not to be due to the ventilation of the rooms by CO_2 determinations, and moreover the sulphur content of the air of the room with gas burning as already pointed out is in most cases diminished.

The important factor is the absorbent action of the ceiling and walls of the room, the sulphur acids being at once fixed by the lime. It has been

shown that dry air passing into closed rooms through the walls, etc., loses a measurable part of its sulphur compounds, and this filtration would be increased by the presence of water vapour.

The fixation of the sulphur by the ceiling was proved by the analysis of the plaster.

Similar analyses were made from the ceilings of two rooms at Victoria Street, Westminster, on February 25th, which were white-washed on December 29th last. Room A is lit by electric light, and practically no gas has been burnt here. The large room, B, has had approximately 10,000 feet of gas burnt in it since December 29th. The percentages of sulphur were found to be as follows:—

Room A, no gas	...	...	0·168 per cent.
Room B, gas ...	...	..	0·504 „

The weight of material used on the ceiling of Room B. was estimated at 45 lbs., so that the whole ceiling of 427 square feet has absorbed 743 grains of sulphur during the eight weeks, which is more than half of that given off by the gas burnt. The gas supplied in this case being Gas Light and Coke Co.'s gas with about 12 grains per 100 cubic feet, or a total of 1,200 grains.

These experiments have shown that:—

1. The air in a room in which no gas has been burning for some time contains less sulphur than the outside air, that is to say, that the incoming air by ventilation through the walls is purified from sulphur.

2. That the theoretical quantity of sulphur produced by burning gas in a room cannot be recovered from the air of a room, but is removed from the air very rapidly, especially in the upper portions of the room, by the basic condition that obtains there, and by the condensation of the water produced on the cold surfaces.

3. By condensing the aqueous vapour in gas-lit rooms it is possible to show that practically a quantitative removal of the sulphur from the air takes place by the condensation of the water.

As the chief product in the combustion of coal gas is water vapour, it follows that all the water above that required to saturate the air will condense on cold surfaces, and in a room of, say, 1,000 cubic feet, the combustion of 50 cubic feet of gas might easily cause 2 lbs. of water to condense after the air has been saturated at, say, 60° Fahrenheit. This water contains most of the sulphur and does not separate usually in the form of fog, but on cold surfaces. Only a minute fraction will normally settle on metals, whilst the greater portion is fixed on the cold basic walls

and ceiling. To ascertain the maximum corrosive effect on iron, I have compared the quantity of water, sulphur acids and iron in the condensed water of the Carron condensing stove in London and Glasgow, under similar conditions, with an Argand burner regulated to 8 feet per hour, and with a run of 4 hours.

It was found that only a very small part of the sulphur has been obtained by the stoves, so that the corrosive effect is less than that which one theoretically would expect from the sulphur content of the gas.

The amount of iron oxidised is in most cases directly proportional to the quantity of sulphur and approximates to 56 parts of iron to every 32 parts of sulphur, showing that it is attacked in atomic proportions, and is at first oxidised to the ferrous condition.

There is thus practically no difference in the effect of London and Glasgow gas, although the sulphur content of the former has been restricted to less than about 20 grains for the past half century.

Experiments on the influence of gases on blood pressure, with Dr. Oliver of Harrogate, now in progress, have shown that carbonic acid raises the blood pressure when ten vols. per 100,000 are present in the air. The blood pressure begins to rise almost as soon as an observation can be made, and within ten minutes attains the maximum point which the percentage of CO_2 present in the air induces, and it remains at this point until the room is well ventilated, when the increment of blood pressure rapidly subsides and disappears.

When the carbonic acid is produced by burning coal gas a similar rise in blood pressure is noticed, notwithstanding the fact that sulphurous and sulphuric acids both have an opposite effect. They are present in such small quantities, therefore, as to have no real physiological action.

Numerous experiments point to the conclusion that carbonic acid in the air raises the blood pressure, and that it quickly falls again in pure air. Small quantities of sulphurous acid act conversely and lower the blood pressure. In air vitiated by the productions of combustion of coal gas, the effect of the carbonic acid outbalances that due to the sulphurous acid present.

The germicidal action of the sulphur compounds, on the other hand, is appreciable on cold surfaces.

The condensed water from a sterilised ice flask suspended in a passage at Victoria Street, with the windows open and no gas, showed an average of 33 organisms per c.c.

In a small room, with approximately 2 cubic feet of gas burning per hour, the condensed water contained 4 organisms per c.c., and 0·01 c.c.

from the window (which was not previously cleaned) was found to be sterile.

A sterile ice flask was suspended in a small room, the gas lighted and the condensed water collected. After four hours the gas was turned off, and the receiver under the ice flask changed without entering the room.

	No. of organisms per cub. ft. of air.
Gas alight	3·0
Gas turned off	0·4

In order that the deposition of the bacteria should be brought to a constant, the small room was prepared overnight, so that the gas could be turned on and off, and known areas of nutrient gelatine exposed, without entering the room.

The room was closed at 7 p.m. on 19th January.

	No. of organisms per cub. ft. of air.
Jan. 20th, 9 a.m.—1 p.m. ... No gas, plate A exposed ...	10·4
„ „ 1 p.m.—5 p.m. ... Gas „ B „ ...	6·4
„ „ 5 p.m.—8 p.m. ... No gas „ C „ ...	5·9

Whether the small amount of sulphurous acid, present in the condensing water, from an atmosphere where gas is burning, could be expected to have any germicidal effect, was determined by the following experiment:—

Three standard solutions of SO_2 in distilled water, containing two parts SO_2 in 1,000, 10,000 and 100,000, were infected with an equal volume of a highly diluted pure culture of B. coli communis; a control being prepared at the same time with distilled water. After four hours' contact, the number of organisms was determined in 0·5 c.c. of each, and found to be:—

Control	942 organisms.
1 part SO_2 per 1,000	0 „
„ „ „ 10,000	20 „
„ „ „ 100,000	636 „

In the four hours the coli had therefore been killed by the SO_2 as follows:—

1 part SO_2 per 1,000	100 per cent.
„ „ „ 10,000	98 „
„ „ „ 100,000	32 „

A similar bacteriological test was then made with B. coli communis, and

the condensed water from a small room, where gas had been burning, at the rate of about 5 cubic feet per hour. A titration of the condensed water showed 9·8 parts of SO_2 per 100,000, and no organisms could be obtained from two c.c. After one hour's contact, it was found that 32½ per cent. of the coli were killed.

Since the above experiments have been concluded, a Departmental Committee of the Board of Trade have recommended the abolition of the sulphur clauses so far as the metropolis is concerned, and there can be no doubt that the few provincial companies and English towns now working under restrictions will speedily follow the practice in other countries.

MR. ROSS (Burnley) said he would like to make one remark about the purification of gas. He did not see what hardships there were in being obliged to purify it. In Burnley, from an economical point of view, they took every precaution to efficiently purify the gas. If the gas was thoroughly freed from ammonia by washing, Prussian blue was formed in the oxide purifiers instead of sulpho-cyanides. A good price could be obtained for spent oxide provided that in addition to the sulphur there was sufficient blue in it. He thought that a great mistake would be made in not purifying the gas, because it ought to be used everywhere in the house for cooking, and in place of coal fires. There was no reason that gas should be sent out with any illuminating power whatever, except to show when it was alight. We could then run the price down probably to 1s. per 1,000, including the cost of distribution, and still have a profit. Everybody then would be able to use more gas.

THE PRESIDENT (Prof. Clowes) thought it was important that he should bring some facts before them. The experiments which Dr. Rideal referred to were well known to him; they were made some time ago, and the results had been used in connection with gas matters in London. Some of the results astonished him at the time when they appeared, and as he was responsible for watching the gas supply in the interests of the consumers he undertook a repetition to some extent of the work to which Dr. Rideal referred. As far as the quantitative estimations of sulphur compounds were concerned he was not satisfied that they should be accepted as proving very much. Accordingly, the quantitative work was discarded and the qualitative method, consisting in collecting the acid products of the combustion of sulphur by condensing the moisture and examining the water, was adopted. The qualitative test for the acid bodies must be acknowledged to be a satisfactory one. He repeated the experiments in the

central parts of London, and he found that the presence of the sulphur acid products was always detectable in the rooms in which the gas had been burning, in rooms which were whitewashed on the ceilings and distempered on the walls. When they came to apply a similar test to the open air they very rarely found any indication of these acid products, except in one case out of 20 tests. They found that these acid producing substances were very freely present in London gas, ordinarily spoken of as purified. There was a reference at the end of the paper to the recent recommendation of the Board of Trade Committee, that the purification of gas from so-called sulphur compounds should be abolished. The actual recommendation was that lime purification should not be insisted on. He could not help hoping that the evidence brought before that Committee in favour of other methods of purification which were being looked into might lead to a purification as complete as that by lime, and possibly even more complete, being used in the future. Whilst it was suggested that lime purification should not be required, a careful testing of the gas for the sulphur compound was proposed, so that evidently that responsible body would not say that these sulphur compounds are not objectionable. No reference had been made to a paper on the subject by Dr. Haldane of Oxford, who is probably the best recognised authority in this country on the hygienic effect of various gases. Dr. Haldane considers that the sulphur products of combustion are most undesirable and in some cases injurious.

THE RELATIONSHIP OF THE BACTERIOLOGICAL CONDITION OF THE UDDER TO THE HEALTH OF THE COMMUNITY.

By JAMES HENDERSON, M.R.C.V.S.Edin.

(From the Royal College of Physicians Laboratory, Edinburgh).

THERE is little doubt that in the majority of outbreaks of disease in man, which have been definitely traced to milk contamination, such contamination is of human origin. If, however, they cannot be traced to human origin, the onus is transferred to the cow, but in a tentative hesitating way suggestive of grave doubt regarding the probable source. In this minority of disease outbreaks, whose origin is ascribed to the cow, many have provisionally and with reasonable doubt been traced to eruptions on the teat and udder. I do not propose to treat of these eruptions, but at the outset must confine my remarks to the conditions which obtain inside of the udder in health and in the commoner inflammations, and the probable danger of infection to members of the community arising therefrom. I shall try to place before you some of the results obtained from the examinations made of a number of diseased udders of cows and of several healthy ones.

In all the cases of mastitis examined the lesions were caused by bacteria. It was not difficult, especially in the acute cases, to find out which species of micro-organisms caused the ravages apparent in the tissues, that is the germs which invaded and predominated in the tissues. But it was not easy to explain why other bacteria of a saprophytic and non-pathogenic nature constantly recurred in these diseased udders in addition to the pathogenic ones, which had originated the inflammations. This led to the suspicion that these saprophytes may be constant inhabitants of the healthy normal udder.

Normal Udder.

In order to determine the correctness of this suspicion a bacteriological examination was made of seven normal udders. Five of these were taken

from cows which had been yielding milk at the time of slaughter, or had been milked up to within a month or two of that time. It was found that 76 per cent. of the cultures made exhibited growths of bacteria. The fact thus disclosed, that bacteria existed in the udders of healthy milking cows, was, though suspected, somewhat of the nature of a surprise, so much so that fellow workers in the laboratory of the Royal College of Physicians, Edinburgh, made independent cultures from the last four of these udders, and their results are included in the 76 per cent. of fertile cultures.

It is unnecessary to burden this paper with a detailed description of all the micro-organisms found, so the following must suffice. In five of the udders various staphylococci were found. In three of them were found pseudo-diphtheria bacilli, presenting all the cultural features of the diphtheria group, but differing from the true diphtheria bacillus in that none of them were pathogenic to laboratory animals, and none of them exhibited a markedly acid reaction in bouillon, though one of them exhibited polar granules when stained by Neisser's method. In two of the udders streptococci were found. Several other species of micro-organisms occurred in individual udders, and it is more than probable that a more exhaustive examination would have disclosed the presence of still more species. None of these micro-organisms were found to be pathogenic to laboratory animals. Two of these normal udders were taken from young heifers and were unexpanded, and all the cultures made from the milk cistern, ducts, and parenchyma remained sterile.*

The cultures yielding the above results were taken under strictly aseptic conditions from various parts of the udder, always excepting the teats. Uhlmann† has recently demonstrated by means of making serial sections of the teats of healthy cows and of goats and sheep that normally they are inhabited by many micro-organisms. The local incidence of bacteria in the internal udder is important in view of the light it throws upon the avenue by which they gain access to it. Cultures taken from the walls of the milk cistern and from the large milk ducts where they enter into it, exhibited more numerous colonies than the cultures taken from the deep ducts. The more remote from the milk cistern the cultures are taken, the colonies become progressively fewer. This also applies to cultures taken from the gland tissue where the ducts are terminal or nearly so. This local incidence, taken together with the fact that bacteria

* The most important results of my investigations are recorded in the March number, 1904, of *The Journal of Comparative Pathology and Therapeutics.*

† *Centralblatt für Bakteriologie, Parasitenkunde, und Infektionskrankheiten, 30th November, 1903, p. 224.*

are very common in the teat canal, points very clearly to the conclusion that the canal of the teat must be the avenue of their advent. Kitt has compared the teat canal to a capillary tube containing a column of milk, which reaches from the exterior of the teat up to the milk cistern. It is by this constantly open avenue that bacteria can gain access to the milk cistern and the internal udder. There is reason to believe that bacteria gaining access by this avenue are confined to the teat canal, milk cistern, and milk ducts, and that they exist there as epiphytes rather than as true parasites.

It is true that in some diseases, such as tubercle, bacteria may be conveyed to the udder by the blood stream, and may by destructive inflammatory processes, gain access to the secreted milk, but the vast majority of micro-organisms must gain entrance to the udder through the canal of the teat.

It is still a vexed question whether normal milk is sterile or not. Most observers have stated that it is sterile, and that if the exterior of the udder be asepticised bacteria-free milk can be obtained. This view has been strongly opposed by some recent continental writers, notably by Leblanc,* Uhlmann (loc. cit.), and Reed and Ward.†

The results of our investigations with regard to the normal udder certainly tend to substantiate this latter view.

The bacteria, whether pathogenic or not, which enter the udder through the teat canal, occur in its immediate external environment, and are conveyed there from the excretions of the cow itself, the dust from the bedding, or from the hands and person of the milker. Much may be done towards abatement of risk to the cow and purity of the milk drawn from it by rigid cleanliness, but it is practically impossible to eliminate such risk on account of the ubiquity of the micro-organisms, and the natural conditions which necessarily obtain in the most carefully kept byre.

MASTITIS.

The cases of mastitis investigated, and which are probably the commonest forms found in this country, may be divided into three classes or types, namely the tubercular, the purulent, and the parenchymatous.

1. *Tubercular Mastitis* has been more exhaustively studied than any of the others, so little need be said with regard to it here, particularly as it has never been credited with causing what may be described as sudden outbreaks of disease.

* "Les maladies des mamelles chez les animaux domestiques," par P. Leblanc. 1901, p. 73.

† Abstract in "Baumgarten's Jahresbericht," 1901, p 32.

2. *Purulent Mastitis.*—The lesion is so designated because the most constant feature of it is the formation of large cavities in the udder filled with liquid pus, which usually burrows to the outside by one or more openings. These cavities often communicate with each other; they have thick connective tissue walls which are lined by a necrotic false membrane of a dark colour, either dark brown or black. On palpation the skin in the neighbourhood of the teat is not only adherent, but is very dense, and from half-an-inch to an inch in thickness. The quarter or quarters affected are greatly increased in volume, and above the thickened skin there are great bulgings caused by the pressure of pus cavities, which have not yet extended to the outside and evacuated. In most cases more or less of the upper third of the udder feels soft and flaccid, and on section is found to be normal except for the passive œdema. The fact that the upper third, or some portion of it, remains uninvaded by purulent processes, while the lower parts show lesions of such manifest chronicity, indicates that the invasion is of a very slow nature. The predominant micro-organisms are streptococci, and the tardiness of invasion indicates that, so far as the udder is concerned, these have a low degree of virulence. Many other bacteria are found in the pus, and they include those usually found in the normal udder.

That the primary lesion is an inflammation of the milk sinus may be deduced from the immense thickening of the skin and of the abscess walls in this neighbourhood. The milking of the affected quarter must therefore be speedily abandoned, on account of the pain and tenderness caused by the act, and because of the pus which would be drawn. But the risk of contamination to the milk supply consists in the fact that on the outside of the diseased udder there is always more or less pus, either dried or inspissated, or newly discharged from the internal cavities. When the sound quarters are being milked, this pus with its swarming bacteria may be dislodged by the rubbing or the shaking, and may fall into the milking pail.

3. *Parenchymatous Mastitis.*—This class includes by far the greatest number of udder inflammations, and exhibits the greatest number of causal micro-organisms. Of the ten cases examined by me, six of the lesions were primarily caused by bacilli of the colon group. In one a colon bacillus and a streptococcus led the invasion, the former abounding in the extensive hæmorrhagic areas, and the latter in every part of the two affected quarters. In another a vibrio predominated, and in some cases, which were subacute, it was difficult to decide which bacteria caused the primary invasion, their species being so varied.

These predominating micro-organisms possessed a virulence sufficiently exalted to invade the entire quarter or quarters affected very rapidly. Their attack was mainly directed against the secreting tissue proper, and they ascended the udder from the milk cistern, by means of the milk ducts, and in the case of the streptococci by the lymph vessels also. They produced great enlargement of the quarter and tension on account of the active œdema, which pervades the whole quarter. There is also pain and tenderness. Variations in the intensity of the inflammation presented in different cases are mainly due to the degree of virulence possessed by the invading organism. If a section be made through an affected quarter in the acute stage, there is a considerable escape of serosanguineous fluid which continues to ooze for several hours. The cut surface is evenly indurated throughout. Its colour may be a light red, or with red areas upon a yellow ground. Instead of red, these hæmorrhagic areas are occasionally purplish. I have always found these hæmorrhagic areas associated with masses of bacilli of the colon type, originating most probably from the alvine discharges.

When the predominating micro-organism has devitalised the tissues, the saprophytes of the normal udder find a suitable pabulum and so increase and hasten the necrotic processes, particularly abscess formation. In subacute and chronic cases of this type a section of the quarter discloses a greyish colour with numerous discrete abscesses, the pus of which is inspissated. In size they vary from microscopic dimensions to those of a walnut. I have not observed in this type any cases in which pus sinuses have opened to the outside of the udder.

Terminations.—The worst cases of this type may cause the death of the cow either by septic intoxication or by septicæmia according to the character of the predominating micro-organism. In some cases there is complete necrosis of the affected quarter or quarters, and sloughing of the same. Others end in destruction of the secreting cells, and subsequent atrophy of the part. Some cases yield to treatment to a certain extent, but the quarters are never restored to their former milking capacity, because a proportion of the secreting cells of the acini, and often the acini themselves, are more or less destroyed; besides, there is always a marked increase in the interacinal and interlobular connective tissue, which accounts for the permanent increase in volume, and slight induration as compared with normal quarters.

It is from these partially restored quarters that the risk of contamination to the milk supply arises. The process of restoration is necessarily a very gradual one, and the period at which it is safe to use the milk from

them is variable. There is always a probability that by using the milk too soon the pathogenic bacteria, which are thus being eliminated, will gain access to the general supply.

The three types of mastitis here referred to include the vast majority of cases which are commonly met with. But other types may occasionally emerge presenting quite different features, because there are many pathogenic micro-organisms capable of producing inflammation of the udder, which have not been mentioned, and probably others whose pathogenic effect on the udder is not yet known.

It is difficult to give an estimate of the percentage of cows in the milking herds of this country which are afflicted with forms of udder disease that constitute a menace to the milk supply. There is an insufficiency of data. Cows having tubercular mastitis have been estimated at two per cent.,* and it is safe to say that the udders exhibiting unhealed lesions of the purulent and parenchymatous types exceed that percentage considerably. Statistics on this subject, collected from city byres where competent veterinary inspection is instituted, are somewhat misleading, because a much worse state of affairs exists in country districts where there is no such inspection, and the great volume of our milk supply comes from such country districts.

The saprophytic bacteria, common to the normal udder, exhibit no pathogenic effect upon laboratory animals, and it may be conceded that they are incapable of producing disease outbreaks in the community. Those micro-organisms, however, which are capable of producing mastitis in cows, may be reasonably suspected of originating such outbreaks. Leaving tubercle bacilli out of account, those which most demand consideration are streptococci and bacilli of the colon type.

Streptococci.—Judging from the effects of this microbe upon the udders of cows, we find great variations in its pathogenicity. It occurs in the normal udder without any apparent effect. In purulent mastitis, as previously stated, it exhibits a low degree of virulence, yet it sometimes is found to invade a whole quarter rapidly, and to cause extensive destruction of the invaded parenchyma. In these last cases its virulence is, apparently, of an exalted nature.

The pathogenic effects upon guinea pigs of these streptococci are very variable. Those of the normal udder and of the purulent mastitis have no apparent effect, when cultures of them are injected into the peritoneum. Those of more exalted virulence only occasionally have a fatal effect. In

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* "Transactions of the British Congress on Tuberculosis," Vol. I., p. 84.

one such case, a culture in bouillon had no apparent effect, while a culture of the same micro-organism on milk produced a fatal effect.

Swithinbank and Newman* write, "Eastes, Holst, Niven, Stokes, Bergey, Hirsch, and others have drawn attention to the ill effects which streptococcal milk has upon persons consuming it. In the main these are twofold, namely gastro-intestinal diseases, and sore throats."

"The evidence implicating streptococcal milk is empirical and circumstantial, and yet it appears to be growing in force and volume."

Again, "Bergey agrees with Beck . . . . that it is most probable that these organisms (streptococci) are not infrequently the cause of serious gastro-intestinal disorders in infants, and probably far more frequently than is generally supposed."

Booker,† who made an extensive investigation of summer diarrhœa in infants is of opinion that streptococci are largely implicated in the etiology of that affection.

Colon bacilli.—With few exceptions bacilli of this type predominated in cases of parenchymatous mastitis. In these cases the micro-organisms exhibited very marked pathogenic effects on the udder. They differed considerably in pathogenic effect upon laboratory animals, and exhibited slight morphological and biological features among themselves. For example, 1 c.c. of a bouillon culture of a bacillus, which appeared identical with the bacillus coli comunis, injected intraperitoneally, killed a guinea pig in ten hours. The same dose of a bouillon culture of another bacillus, which did not coagulate milk, killed a guinea pig in twenty-four hours. In the case of another bacillus, which in early sub-cultures exhibited vacuoles at one or both ends (involution forms), the injection intraperitoneally of 2 c.c. of a bouillon culture failed to affect a guinea pig or a rabbit, while ·5 c.c. of the same culture, injected intraperitoneally into a white rat, killed it in thirty-six hours.

It is probable that only cases of mastitis of the parenchymatous type, which are caused by colon bacilli of a low degree of virulence, are amenable to treatment, by means of which the milking capacity of the affected quarters is partially restored. Professor Delépine‡ by inoculating guinea pigs with many specimens of unmixed milk drawn into sterilised bottles from diseased udders, other than those of tubercular origin, found that a smaller percentage of rapidly fatal infections resulted, than was the

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* "Bacteriology of Milk," 1903, pp. 222 and 223.

† "The Johns Hopkins Hospital Reports," Vol. VI., p. 251. William D. Booker, M.D.

‡ *The Journal of Hygiene*, Vol. III., 1903, p. 81.

case when specimens of ordinary mixed milks were inoculated. It is not stated, however, whether the unmixed specimens examined by him were drawn from the quarters actually diseased, or from the sound quarters of partially diseased udders. He concludes (loc. cit., p. 90) that "Epidemic diarrhœa of the common type occurring in this country is apparently in the great majority of instances, the result of infection of food by bacilli belonging to the colon group of bacilli, which are present at times in fæcal matter. . . . . Of the bacilli of the colon group, which are capable of rendering the milk infectious, those which do not produce a large amount of acid and do not coagulate milk are the most virulent, and are probably the essential cause of epidemic diarrhœa." A bacillus answering somewhat closely the description in this last sentence was found to be the predominating invading germ in one case of parenchymatous mastitis out of the ten examined by me.

The most virulent of these colon bacilli—including the one above mentioned—produced in the udder an inflammation of such intensity and such widespread tissue destruction, with subsequent necrotic processes in the subacute stages, that even partial resolution seemed impossible. It must be borne in mind that such micro-organisms enter the internal udder by the teat canal, and that they may appear in the milk before they infect the internal udder. So that the true significance of mastitis is that it constitutes a danger signal indicating the presence of these micro-organisms in the immediate environment of the affected udder.

What is now wanted is a comparison of the causal micro-organisms in cases of supposed milk-borne disease in the human subject with the micro-organisms causing the diseased condition of the udder.

Dr. J. J. Weaver (Southport) said that they had had rather an interesting case bearing on the question, showing that there was considerable difficulty in dealing with these cases. A lady had brought some milk to them for examination and they found tubercle bacilli in it. Six weeks afterwards, on receipt of the bacteriological report, they went to the cowkeeper from whom the milk came, and they found two cows on his premises that looked suspicious. They got a veterinary surgeon to examine them, and he pronounced them both tubercular. With the consent of the owner one cow was killed, and was found admittedly tubercular. The owner refused to have the other cow slaughtered, and denied that it was tuberculous. In the end the cow got better, fat and well, and was living to-day as far as he knew. He would like to know from any

veterinary surgeon if it was possible to have tubercular disease of the udder and for it to get well. Our veterinary surgeon said no, but the cowkeeper said it could. The cowkeeper made a large claim as compensation for loss of milk, &c., against the Corporation, and they had to pay him a considerable sum to get out of the difficulty.

Mr. Alfred Holburn (Manchester) said that the paper was very interesting, particularly from its bacteriological aspect. Alluding first to the remarks of the medical officer of health for Southport, Mr. Holburn believed it was possible that they could get milk contaminated without the cow showing any clinical evidence of udder disease, indeed such cases had come under his notice. After the onset of infection a certain time must elapse before the tissue reaction would become clinically manifest—a tuberculous focus not recognisable—and it is highly probable that small areas of infection may occasionally become encapsuled by fibrous tissue and recovery take place, especially if the cow is about to be dried off, when the activity of the udder ceases. He thought the best thing the Southport people could have done was to have had the cow tested with tuberculin, which was a most helpful test in a case like the one mentioned. With regard to the etiology of these forms of mastitis set out in Mr. Henderson's paper, the author seemed to want them to believe that the infection was in nearly every case through the teat canal. To this Mr. Holburn could not agree. He did not think that nodular mastitis was due to infection through the teat, these nodules were often peripheral and occurred without suppuration of the milk ducts, which ought to have been the first place infected if the bacilli got there through the teat. Again, Mr. Holburn could not accept the opinion that acute parenchymatous mastitis was due to organisms that reached the udder through the teat canal. He considered tuberculosis of the udder a good criterion as to how bacilli reached there. He would also like to ask Mr. Henderson if he had inoculated the udders of healthy cows with any of these organisms he had isolated?

Mr. J. S. Lloyd (Sheffield) said he could not agree with Mr. Henderson as to his limiting the matter to an affection of skin lesions on the teats and udder. He was inclined to think that very possibly they were breeding places for streptococci. He disagreed with the remarks of Mr. Holburn that purulent mastitis took place by an affection of the blood stream. It might do, but he did not think it was common. It was usually seen after cows had been dried off, and he found in hundreds of cases that after a long spell of wet weather, if the cow was lying in long grass, there seemed to be quite an epidemic of that kind amongst the cows in the same field. They ought to be thoroughly dried off. Some people milk them every day for a matter of a week, and then leave a quantity of milk in the udder which does not become absorbed, and it becomes a breeding place for bacteria. Mr. Henderson seemed to think that purulent mastitis caused sore throats in people.

He did not know whether that was what he meant or not. They were all satisfied that disease of the udder produced diseased milk, and that diseased milk ought not to be sold for consumption. He was sorry to say that the steps which had been taken to prevent diseased milk being sold to the public were very few. The Local Government Board recommended that steps should be taken to deal with tuberculosis in the udder of milking cows. He would like to say, in answer to Dr. Weaver, that he was carrying on an investigation in regard to tuberculosis of the udder, and at present he had a cow which he examined last February having a diseased udder. The milk was taken under aseptic conditions, and two guinea-pigs were inoculated with it, the result being that one guinea-pig got the disease and the other did not. In the meantime the cow improved in condition, and the udder was no worse. At the time she was getting near calving and he took a second sample from her, and it had no effect on the guinea-pigs. Last week he took a third sample—she was due to calve within the next month. He had another case in Derbyshire three years ago where he had a cow on the point of calving. He saw her six months afterwards when she was dried off, and the diseased condition of the udder was very much less marked.

Dr. Buchanan (Glasgow) said that his experience was somewhat like Mr. Lloyd's. A farmer had brought a tubercular udder to him the other day with very marked evidence of tuberculosis, and the milk from that cow failed to kill guinea-pigs. He could not offer any explanation of that unless it be that the tubercular focus in the udder was surrounded by newly-formed tissue. It was an old tubercular lesion. He agreed that tuberculous milk did not always produce tuberculosis in the guinea-pigs. In his laboratory he had always two guinea-pigs inoculated from the particular sample of milk, and he found that not infrequently one of them took tuberculosis and the other did not, so that without that precaution one might come to a wrong conclusion.

Mr. J. Henderson (Edinburgh), in reply, said that Mr. Lloyd had already answered Dr. Weaver about the tubercular mastitis, but still he might have a little to say. As a rule tubercle in the udder was a constant and final invasion. He thought there must be some mistake about the cow Dr. Weaver referred to. Very likely it was not tuberculous at all, because the cow was not likely to have recovered; such cases usually go from bad to worse. Mr. Holburn referred to suppurative mastitis, and the impossibility of the streptococci ascending the udder through the teat canal. Professor Kitt of Germany has stated that the teat canal is a capillary tube full of milk, by which bacteria could constantly gain access to the internal udder. That they do constantly gain access has been proved by Uhlmann, who took the teats of various cows, and by serial sections of them demonstrated the presence of great numbers of bacteria. Besides this it can be shown that in the normal udder more bacteria can be found in the milk cistern than in the milk ducts, and that the deeper you go into the tissue to make

your examination the numbers of bacteria in the milk ducts are fewer. He thought that the teat canal was the origin of access in every case, and that it was not necessary to have an abrasion of the skin in order to have an invasion of the udder. There were constantly bacteria in the normal udder which came up through the teat canal, but the fact that they were there and did no harm was due to their lack of virulence. With regard to the coli group of bacteria and injections of them into animals, inasmuch as he had to bear the expense of the animals, he could not afford to buy cows to inject the bacteria into, but he had used a great many guinea-pigs, and in the most virulent cases of mastitis injection of the causal bacteria produced death. He thought that such bacteria produced so intense an inflammation that there was no chance of the affected quarter being milked, and so constituting a direct contamination. But the fact that the microbe was there, in the immediate vicinity of the cow, probably originating from the alvine discharges, made it exceedingly likely that some of the germs from that source reached the milk supply. He thought it would be a very interesting experiment, when a cow with mastitis was suspected of being the origin of a milk-borne outbreak of disease, to have the cow slaughtered and the udder examined bacteriologically, to find whether the predominating organism in the udder was the same as that causing the outbreak. If it were found to be the same, they would have attained something definite. If it were not the same, then they would have the mastitis excluded. Along these lines they might be able to make some progress. He did not say that streptococci caused sore throats; it was very likely, but he thought that was not a settled point. He suggested that in these virulent cases of suppurative mastitis the pus, in a dry state or even a fresh state, was liable to fall into the pail when the sound quarters were being milked. If there was anything in the theory of sore throat being caused by streptococci, he thought this would be a very frequent source of contamination. He had found streptococci in the normal udder.

EXPERIMENTS IN THE PURIFICATION OF BREWERY REFUSE.

By H. McLEAN WILSON, M.D., B.Sc.

(Member).

IN 1902 Messrs. R. J. Bentley's Exors. of the Old Brewery, Rotherham, employing as their engineer Mr. R. E. W. Berrington, who was then carrying out a sewerage and sewage disposal scheme for Rotherham, constructed works for the purification of their brewery refuse before its discharge into the river Rother.

These works, although constructed at considerable cost, were not effective, and after various suggestions as to the methods of working them had been made to Messrs. Bentley, and had been tried unsuccessfully, the firm kindly allowed the use of the plant for purposes of experiment.

The refuse from the brewery is derived from malting and from the brewing of beer and porter. The malting process is only carried on for part of the year, and at intervals also, during part of the period of experiment, large quantities of waste yeast were discharged by the brewery drains to the purification works. All cooling and refrigerating waters are discharged by a separate outlet direct to the river. The quantity of refuse, as in all breweries, varies greatly from day to day and from hour to hour, but on an average amounts to some 10,000 gallons a day.

The purification plant at the time the experiments were begun consisted of two settling tanks, each of a capacity of 4,680 gallons, and four filters, each 22 feet × 10 feet by 3 feet 3 inches deep, filled with washed coal of pea-nut size. The plant was arranged in duplicate series, and the refuse was passed through one or other tank, distributed by perforated half-pipe carriers on the surface of one filter, through which it was allowed to percolate continuously to under-drains of 9 inch perforated pipes, and treated again in the same way on a second filter, the effluent from which was discharged to the river. The distribution on the filters was never efficient, with the result that the greater part of the filtering material was not brought into use. Analyses are appended showing the nature of the

crude refuse and the results of treatment at that time, and the diagram (page 581) will show the details of the tanks and filters.

The chief peculiarity of brewery refuse is that it rapidly undergoes acid fermentation, and while in an acid condition is very refractory to the action of the ordinary purifying organisms. In the table of analyses (pages 584–588) it will be seen that a large number of samples, which were neutral to litmus paper at the time they were taken, became strongly acid before they were analysed.

In planning the experiments it was recognised that no efficient purification was to be looked for, so long as the refuse was allowed to undergo acid fermentation, and various methods were adopted to prevent this and to destroy any acidity already present in the crude refuse; and advantage was taken of the duplicate arrangement of the tanks and filters to carry out two sets of experiments side by side.

In one side of the installation the effect of a septic tank treatment of the refuse was thoroughly tried. On May 18th, 1903, 15 cwts. of sludge, obtained from a septic tank at neighbouring sewage works, was placed in the tank and thoroughly mixed with the refuse. A small scum soon began to form on the surface of the tank, and increased after the addition of another 10 cwt. of septic sludge to the tank contents, but the tank effluent remained as acid as before, and as this scum consisted in great part of spent grains and hops it was certainly not entirely due to septic action.

From the 23rd to the 29th May a bucket of milk of lime was put into the septic tank daily by mistake. This caused the scum to disappear almost wholly, but reduced the acidity of the tank effluent slightly though not entirely.

From the 3rd to the 12th of June additional quantities of septic sludge mixed with water were added to the tank and no waste was allowed to enter, the idea being to get septic action started and a scum formed; but very little scum formed even then, and the acidity was only temporarily neutralised when the whole of the tank contents were stirred up, returning again when they were allowed to rest.

The septic tank was then covered with boards, and after a few days a scum began to form, which gradually increased until it was 6 inches thick at the inlet end of the tank, thinning down to a mere skin at the outlet end; but this scum again was chiefly composed of spent grain and hops. The acidity of the tank effluent was moreover only slightly reduced, and never entirely neutralised, and the offensive smell arising from the works was so bad that continual complaints were made by the workmen and proprietors of a mill adjoining.

On the 13th July it was found that it was the practice to discharge all the waste yeast which could not be sold, down the brewery drains, sometimes to the extent of six or seven casks a day. This, however, was then stopped, with the result that a much less acid tank effluent was obtained.

This tank was used as a septic tank from the 5th May up to the 31st July, and on no occasion had it produced an effluent free from acid, while the stench from it had become so bad that the brewery proprietors were threatened with an action for the abatement of the nuisance by the proprietors of the adjoining premises, whose workmen had all signed a notice to leave their work on this account.

On the 31st July the septic tank was emptied of sludge, when it was found that the scum at the inlet end was 6 in. thick and that there was 22 in. of sludge in the bottom of the tank, of a black, putrid, and most offensive character, but alkaline in reaction. This sludge was carted away during the night to a field 500 yards from the road, but even at that distance its offensive smell was so great that complaints were made by people passing along the road, and the whole of the sludge had to be covered with chloride of lime.

The only conclusion to be arrived at upon this experiment is that the method of attempting to deal with brewery refuse by septic tank treatment, even with the addition of a septic sewage sludge, is not one to be recommended. The process causes most offensive smells and does not produce an effluent free from that acidity which is the great hindrance to the bacterial treatment of the tank effluent. The chief good effected is the removal of suspended matters, an end which may be better attained by other methods.

While the foregoing experiments were being made, the other side of the installation was being used for the chemical treatment of the refuse. In the first place this tank, having been emptied and cleaned out, was filled up on the 15th May, 1903, with the crude refuse, to which 120 gallons of saturated lime-water were added to render it alkaline. Half the refuse from the brewery was then passed through the tank, and 30 gallons of lime-water were added twice a day. This was not found sufficient to keep the tank effluent neutral, and for a time lime-water in a constant flow, equal to 60 gallons for each tankful of refuse, was added to the tank effluent as it passed to the filters. Even this did not act satisfactorily, and by experiment it was found that 300 parts of saturated lime-water were needed to render 400 parts of the crude refuse alkaline.

Dry slaked lime was then used and thoroughly stirred up with the

refuse in the tank, when it was found that 72lbs. of lime were required in the first place to neutralise the tank full, equal to 107 grains per gallon, and after this 28lbs. of lime per day to keep the tank effluent neutral, this latter quantity being added to the tank at the inlet end. But at times when quantities of yeast were discharged from the brewery it was practically impossible to keep the tank effluent neutral, and for several days after such a discharge the tank effluent remained strongly acid.

The discharge of yeast from the brewery was stopped, as has been stated, and it was afterwards found that milk of lime produced a better effect, although it had to be added in the proportion of 30 to 150 grains of lime to the gallon of refuse. By keeping out the yeast and removing the sludge from the tank at frequent intervals, it was finally found that in the form of milk of lime about 45 grains of lime to the gallon of refuse was generally sufficient to keep the tank effluent neutral.

This precipitation produced a large quantity of sludge, and after ten weeks' working the tanks were cleaned out and it was found that they contained nineteen cartloads of solids. These, although rather offensive, were not nearly so productive of nuisance as the sludge from the septic tank.

Other experiments in chemical treatment of the refuse were made in a 36 gallon cask, which was filled with the refuse mixed with the precipitant and allowed to stand until the suspended solids had settled. For several weeks in November copperas in amounts varying from 5 to 11 grains per gallon, and afterwards manganate of soda, 8 grains per gallon, and aluminoferric in small amounts, were at different times added along with the lime, but although these precipitants seemed to hasten the deposition of solids they made no practical difference in the tank effluent.

One of the greatest difficulties in the tank treatment of the refuse was the very irregular flow of the waste. Generally in the earlier part of the day the flow was comparatively small, sometimes not reaching more than about 10 gallons per minute, while during the afternoon it would more often be about 15 gallons, with occasional heavy flushes at the rate of 75 gallons. These flushes caused such a current through the tanks that the sludge in them was stirred up, and much of it carried on to the filters, with the result that these were partly choked up with a yeasty mass of fermenting matter, which doubtless led to the further production of acid in the effluent.

Before commencing experiments upon the bacterial treatment of the tank effluent, the distributing pipes of the first filter were taken up and relaid in a bed of fine ashes about 6 ins. deep, so as to insure a better distribution over the whole of the surface of the bed and to prevent

suspended solids from getting into the body of the filter, and valves were placed at the outlets of the beds for the purpose of holding up the liquid, after Dibdin's method.

The effect of double contact was first tried, as follows:—The first filter was filled according to the flow of refuse, allowed to stand full for two hours, emptied rapidly, and allowed to remain empty two hours, and the second filter was used in the same way. At night when little waste was being discharged from the brewery the valves from the filters were left open and the tank effluent allowed to percolate continuously through, while at the same time thorough aeration of the bed was insured.

It was found that the flow of refuse was at times too great to allow the ordinary cycle of filling, standing full, emptying, and standing empty, to be carried out, and this sometimes caused the filters to be filled four or five times a day, between 6 a.m. and 5 p.m., although occasionally the filters could be allowed more than two hours' rest. The filtering material was periodically examined and found to have a large quantity of yeast adhering to its surface in a partly decomposed and most offensive state. It was thought that by laying a layer of fine ashes on the surface of the filter as stated, any further accumulation of this yeast deposit in the body of the filter would be prevented, and that already in the filter would eventually be decomposed and disappear; but this result was not attained, and at the end of these experiments this coal filter remained clogged with offensive matter.

On the 1st July, with a view of assisting the second bed in this recovery, perforated distributing pipes were fixed on it, through which the effluent from the first filter could be sprayed, and a layer of limestone chippings about 2½ in. thick having been laid on its surface, the filter was used for a short time continuously. This reduced the acidity of the effluent for a time, but it soon returned, and the filter was again used as a contact bed.

This first series of filters was fed from the 18th May to the end of July with an acid effluent from the septic tank, and good results were therefore scarcely to be looked for; but after the latter date the filters were fed with an alkaline effluent produced by the lime treatment of the refuse, and it was hoped that in time they would recover and be able to produce a considerable amount of purification on such an effluent. This was not, however, found to be the case, and up to the end of the experiment these coal filters remained in an unsatisfactory state, causing the effluent to be acid even when the filter was fed with an alkaline tank effluent.

After testing for some months the possibility of the recovery of the

filters, the material in them was thoroughly examined and found to be still clogged with fermenting, yeasty sludge. It was then determined to remove the whole of the filtering medium from the filter beds of one side, and to replace it with ashes arranged as follows:—The first filter was underdrained with channels formed of loose bricks laid upon the concrete bottom of the bed, and the bed was then filled with four layers of riddled ashes, the bottom layer consisting of six inches of clinker sized from 1½ in. to 1 in., then 12 inches from 1 in. to ¾ in., twelve inches from ¾ in. to ½ in., and the top nine inches from ⅜ in. to ⅛ in.; three feet three inches in all. The second bed, underdrained in the same way, had twelve inches of riddled ashes of 1 in. size, twelve inches of ¾ in., nine inches from ⅜ in. to ⅛ in., three inches of fine limestone chippings, and again, three inches of fine ashes free from dust; three feet three inches in all. In order, however, to catch the fine suspended matter carried forward from the settling tank by the flushes of liquid, the first bed was covered at the inlet end with an extra layer of fine ashes three inches deep.

These filters were brought into operation on the 8th September, and have been used regularly since that date. The effluents have been always neutral at the time of discharge, although occasionally they have become acid on keeping. The amount of purification effected will be seen in the table of analyses; and, besides the purification shown, it is to be noted that the physical characters of this effluent were a great improvement upon that from the coal filters, as it had lost nearly all the offensive smell of pig manure, so characteristic of decomposing brewery refuse. After this date, moreover, a great difference was noticeable in the Rother at the point where it receives the discharge from the brewery. The river at this point, and down to its junction with the Don, some three hundred yards away, is very sluggish in its flow, and formerly, except in wet weather, was covered with filthy and extremely offensive scum. This scum and offensiveness have now almost entirely disappeared, and the effluent from the brewery thus treated produces no marked effect upon the stream.

The analyses show, however, that precipitation of the refuse followed by double contact is not sufficient to produce a thoroughly satisfactory effluent, judged by a chemical standard, for the amounts of oxygen absorbed and of albuminoid ammonia present are much higher than would be considered passable in an effluent from any sewage works, and on no single occasion were any nitrates present.

While these experiments were being carried out with the large filters, smaller experimental filter beds were constructed and brought into use. At the end of June, two 36-gallon casks were filled, the first with coke

varying in size from pieces of an inch at the bottom to pieces between $\frac{3}{8}$ and $\frac{1}{8}$ of an inch in the top layer, and 2 ft. 8 in. in depth altogether; the second of the same depth, with the same size coke in the bottom, but with the top 6 in. filled with Trent sand. The water capacity of each of these filters was $22\frac{1}{2}$ gallons at first, but rapidly fell to 18 gallons, and remained at that figure.

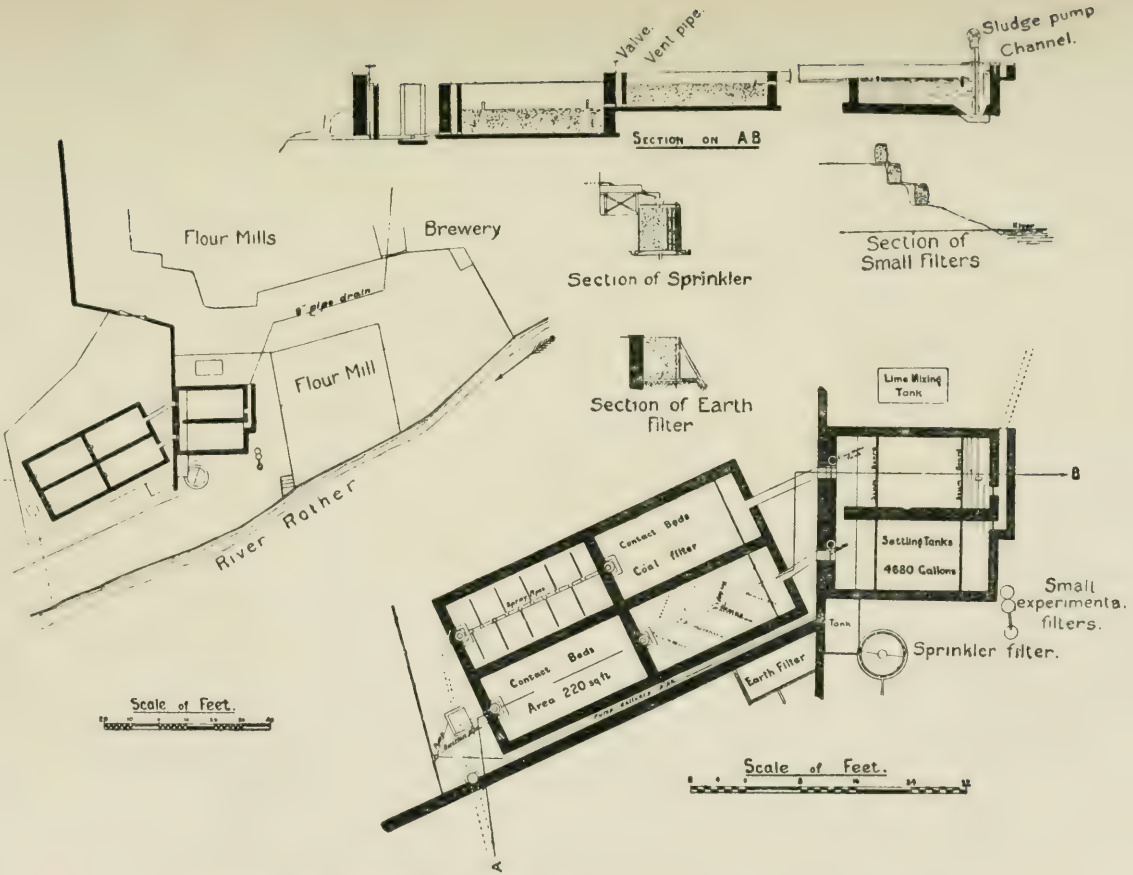
On October 12th a percolating or trickling filter was constructed in a similar cask of coke breeze in pieces about 1 in. in size, partly new and partly taken from some Dibdin contact beds which had been in use for a long time at adjoining sewage works.

At first the brewery refuse was diluted to the extent of 30 per cent. by mixing with it river water along with a little sludge from the septic tank of adjoining sewage works, and this mixture was supplied to these filters and given two hours' contact in each. After a few days a fairly good effluent was obtained, but before any reliable test could be made the sand in the second filter became choked, and the filter became useless. By turning the sand over, the filter was again brought into use, but choked up again, and finally the sand was removed, and in each filter a layer of fine stone chippings was placed on the surface of the coke.

These three cask filters were used in the first place for dealing with the effluent which was produced by the settlement of the refuse precipitated in the cask which has already been mentioned, but after the 21st December were fed with the effluent from the ash filter, and after this the third cask filter was provided with a tap and used as a contact bed.

The brewery refuse could thus be subjected to chemical precipitation by lime and other precipitants and double contact in the large ash filters, followed by triple contact in the cask filters of coke. Even this did not produce a satisfactory result, as will be seen from the table of analyses, and on no occasion did any nitrates appear in the effluent. It was therefore decided to experiment further with the effluent from the ash filters.

A larger sprinkler filter was therefore constructed and brought into operation on the 9th November. This filter was constructed on a concrete foundation which sloped from the centre to the circumference, the filter being circular in shape, six feet in diameter and six feet deep. On the concrete floor a layer of stones was laid for drainage purposes, on which the filtering material was built up. The material was coke breeze, about a quarter of which had been obtained from some first contact beds at sewage works, and the remainder being fresh from the gas works. The pieces were about the size of apples, and were held in position by upright boards placed at intervals and supported by iron bands.



Works for Purification of Trade Waste at Old Brewery, Rotherham.

For the supply of this filter, a storage tank having a capacity of 225 gallons was fixed at a sufficient height. This tank was fed by a pump from the valve chamber of the second ash contact bed, and from the tank the liquid was supplied to the filter by means of a rotating sprinkler. The tank was filled twice a day and discharged each time on to the trickling filter in the course of one hour, giving a quantity of some 75 gallons per square yard, treated upon the filter twice a day, the filter being allowed to rest for the remainder of the day.

The result of this extra treatment was at once apparent, the effluent being free from smell, clear and not frothy, and these improved results have been steadily maintained. The appended analyses will show, however, that even by this treatment of lime precipitation, double contact, and percolation, no nitrates were produced in the effluent, and the rate of filtration was therefore greatly reduced, the ash filter effluent being supplied in intermittent doses every five minutes for eight hours a day to the amount of about 140 gallons per square yard per day. By this reduction in the rate, and this method of application, the results obtained were greatly improved and nitrates appeared in the effluent; and when the filter effluent had been strained through sand to remove from it the suspended solids which are invariably found in the effluent from a percolating filter, the resulting filtrate was one which could be said to be very satisfactory.

A further experiment was made with a view of ascertaining the effect of filtration through natural soil upon such an effluent, and for this purpose an earthen bed was constructed and brought into use on January 11th. This bed was 11 ft. × 5 ft. × 5 ft. 6 in. deep. It was constructed, on a bricked and grouted floor, of gravelly and loamy soil taken at a depth of four feet from some neighbouring excavations, with a covering of 1 ft. 6 in. of good garden soil and grass turf. An underdrain lying on the brick floor was provided for the purpose of collecting samples.

On to this bed the effluent from the ash filter could be pumped, and was supplied to the earth bed in quantities of some 100 gallons, which was found to be the quantity the filter would take without overflowing, the bed being used on the principle of intermittent downward filtration.

The results of this treatment have been, as will be seen from the table, very similar to those obtained by the use of the sprinkler filter, and the effluent produced has generally been very satisfactory, having a low oxygen-absorbed figure and showing nearly always the presence of nitrates in appreciable quantities.

These results show that although brewery refuse is more refractory

than domestic sewage, it is quite practicable to purify it by ordinary bacterial means, aided by a preliminary treatment with lime.

Taking the average results from the table of analyses, the precipitation with lime produces a tank effluent in which as compared with the crude refuse the suspended solids have been reduced from 24·8 to 13 parts per 100,000, and the albuminoid ammonia from 3·8 to 1·8, while the oxygen absorbed figure is increased to 32·7; it produces, moreover, a liquid which no longer has an acid reaction, although in such a condition that the acidity soon returns. The alkalinity, however, persists long enough to permit of bacterial purification taking place.

The double contact treatment of this neutral or alkaline tank effluent further reduces the albuminoid ammonia from 1·8 to ·7, and brings the oxygen absorbed figure from 32·7 to 7·9—quantities which are still much too high to be satisfactory. The percolating filter fed with the effluent from the contact beds produces an effluent which, when strained through sand, may be considered very satisfactory, the albuminoid ammonia being reduced to ·15 parts per 100,000, the oxygen absorbed to 1·8, while nitrates have made their appearance, and the earth filter yields nearly the same result.

The purification thus effected by chemical precipitation, double contact, percolation, and sand straining, when judged by the amount of albuminoid ammonia, amounts to some 96 per cent., and when reckoned on the oxygen absorbed figure to some 93 per cent.

It will be seen that the course taken by the experiments was to a great extent determined by the nature of the existing works. In constructing works anew for the purification of such refuse, the best course to take would probably be to provide tanks for chemical treatment, a first percolating filter, and another at lower level, and finally a shallow strainer of sand for the removal of suspended matters. The tanks should not be too large, for fear of inducing acid fermentation in their contents, and the filters should be of sufficient area to allow of only a moderate quantity per yard being passed through them. With such an apparatus there should be no difficulty in producing an effluent quite fit to be discharged into a stream.

BREWERY REFUSE.

(Results expressed in parts per 100,000).

Water used.

Source.	Solids.			Chlorides. (as NaCl).	Nitrogen.			Oxygen absorbed in 4 hrs. at 80° F.
	Total.	Loss on Ignition.	Ash.		Nitric.	From Free and Saline Ammonia.	Albumd. (Wanklyn).	
Town's supply	8·5	3·0	5·5	2·0	trace	0·005	0·010	0·17
River supply	131·0	16·0	115·0	51·0	0·10	0·193	0·029	0·21

Effluent from Works before Experiments.

Treatment.	Date taken.	Date analysed.	Nitrogen.			Oxygen absorbed in 4 hrs. at 80° F.	Acidity.		Remarks.
			Nitric.	From Free and Saline Ammonia.	Albumd. (Wanklyn)		When taken (to litmus)	When analysed (as lactic acid)	
Settlement and Double Continuous Filtration (coal)...	3-11-1902	10-11-1902	—	—	—	9·98	—	Slight.	
Do. do. ...	15-2-1903	14-2-1903	—	1·45	3·09	25·60	—	84·6	
Do. do. ...	10-2-1903	14-2-1903	—	1·53	2·61	24·80	—	73·8	
Separate Wastes.									
Nature of Liquid—									
Barrel Washings	15-1-1903	23-1-1903	—	0·40	13·00	63·55	—	9·0	
Copper Washings	17-1-1903	26-1-1903	—	0·65	3·14	79·80	—	4·5	
Fermenting Vessel Washings	15-1-1903	22-1-1903	—	0·50	27·28	74·70	—	34·2	
Yeast Vessel Washings ...	15-1-1903	26-1-1903	—	1·30	50·50	113·00	—	54·0	
Waste Yeast	4-5-1904	7-5-1904	—	9·00	818·00	1660·00	Acid	720·0	The discharge of this waste was stopped in July.
Mixed Refuse untreated.									
Mixed Refuse	15-1-1903	24-1-1903	—	0·26	2·85	26·30	—	14·4	
Do.	10-2-1903	13-2-1903	—	0·35	3·60	27·88	—	10·3	
Do.	27-10-1903	31-10-1903	—	0·30	4·40	25·88	—	61·2	
Do.	12-11-1903	17-11-1903	—	0·45	6·35	22·30	—	36·0	
Do.	17-5-1904	20-5-1904	Nil	0·22	1·98	21·90	—	25·2	

Average Tank Effluents.†

Treatment.	Date taken.	Date analysed.	Nitrogen.			Oxygen absorbed in 4 hrs. at 80° F.	Acidity.		Remarks.
			Nitric.	From Free and Saline Ammonia.	Albumd. (Wanklyn)		When taken (to litmus)	When analysed (as lactic acid).	
Settlement only	10-2-1903	13-2-1903	—	1·20	2·73	26·90	Nil	60·3	
Precipitation (Lime)	4-5-1904	6-5-1904	Nil	0·88	2·62	42·50	Nil	64·8	
Do.	17-5-1904	20-5-1904	Nil	0·20	1·45	30·30	—	58·5	
Do.	25-5-1904	26-5-1904	Nil	0·22	1·35	25·40	—	39·6	
Precipitation (Lime and Aluminoferric)	19-11-1903	21-11-1903	—	0·68	1·45	15·10	Nil	174·6	
Precipitation (Lime and Copperas) ...	12-11-1903	17-11-1903	—	0·55	1·40	9·46	—	*20·7	*Alkalinity as Ca O.
Do. do. ...	9-5-1904	12-5-1904	Nil	0·95	1·80	24·92	Nil	52·2	
Do. do. ...	12-5-1904	13-5-1904	Nil	0·50	1·66	25·52	—	28·8	
Precipitation (Lime, Copperas, and Manganate of Soda)	9-5-1904	12-5-1904	Nil	1·10	1·83	25·48	Nil	54·0	
Do. do. ...	12-5-1904	13-5-1904	Nil	0·50	1·45	28·32	—	46·5	

† These effluents contained Solids in Suspension = 13·2 (average of four samples).

Coal Filter Effluents.

Septic and double contact (sprayed on second bed)	1-7-1903	3-7-1903	—	—	—	9·20	—	63·0	
Precipitation (Lime) and continuous double filtration	1-7-1903	3-7-1903	—	—	—	8·70	Nil	51·3	
Precipitation (Lime) and double contact (sprayed on second bed)	14-9-1903	24-9-1903	—	0·16	0·94	7·60	Acid	30·6	
Do. do. ...	27-10-1903	30-10-1903		0·28	0·59	6·68	Acid	47·7	
Do. do. ...	3-11-1903	9-11-1903	—	0·77	0·89	7·82	Acid	39·6	
Do. do. ...	29-2-1904	3-3-1904	Nil	0·83	0·70	12·44	Acid	39·6	
Precipitation (Lime, Copperas, and Sodium Manganate) and double contact (sprayed on second bed) ...	27-1-1904	28-1-1904	Nil	15·93	2·09	12·00	Nil	50·4	

Effluents from Casks.

Treatment.	Date taken.	Date analysed.	Nitrogen.			Oxygen absorbed in 4 hrs. at 80° F.	Acidity.		Remarks.
			Nitric.	From Free and Saline Ammonia.	Albumd. (Wanklyn)		When taken (to litmus)	When analysed (as lactic acid).	
Precipitation (Lime) and single contact...	1-7-1903	3-7-1903	—	—	—	6·20	Nil	41·5	
Do. double contact...	1-7-1903	3-7-1903	—	—	—	2·30	Nil	23·4	
Precipitation (Lime and 30% sewage) and double contact	14-9-1903	18-9-19 3	—	0·04	0·44	4·06	—	sl. alk.	
Do. do.	22-9-1903	26-9-1903	—	Nil	0·14	2·18	—	sl. alk.	
Precipitation (Lime and 30% sewage double contact & continuous filtration	21-10-1903	22-10-1903	—	Nil	0·32	3·72	—	sl. alk.	
Do. do.	3-11-1903	6-11-1903	—	0·03	0·26	2·88	—	sl. alk.	
Precipitation (Lime) double contact and continuous filtration	27-10-1903	30-10-1903	—	Nil	0·16	3·14	—	Nil	
Precipitation (Lime and Copperas) ..	12-11-1903	17-11-1903	—	0·55	1·40	9·46	—	20·7*	*Alkalinity as CaO.
Precipitation (Lime and Copperas) and double contact	12-11-1903	16-11-1903	—	Trace	0·45	5·28	—	Nil	
Precipitation (Lime and Copperas), double contact & continuous filtration	12-11-1903	16-11-1903	—	Trace	0·34	4·60	—	Nil	
Do. do.	11-11-1903	16-11-1903	—	Nil	0·65	8·58	—	Nil	
Precipitation (Lime and Aluminoferric) and double contact	19-11-1903	20-11-1903	—	0·12	0 77	9·14	—	sl. alk.	
Precipitation (Lime and Sodium Manganate) double contact and continuous filtration	1-12-1903	4-12-1903	Nil	0·06	0·23	4·36	—	v. sl. alk.	
Precipitation (Lime and Sodium Manganate) and triple contact...	8-12-1903	14-12-1903	Nil	Nil	0·18	5·26	—	sl. alk.	
Precipitation (Lime and Copperas, double contact (ashes) & triple contact (casks)	21-12-1903	23-12-1903	Nil	Trace	0·39	6 00	—	v. sl. alk.	
Precipitation (Lime, Copperas & Sodium Manganate) and triple contact... ...	1-1-1904	4-1-1904	Nil	Nil	0·19	4·34	—	sl. alk.	
Do. do.	18-1-1904	19-1-1904	Nil	Trace	0·23	2·98	—	sl. alk.	
Precipitation (Lime, Copperas & Sodium Manganate) double contact (ashes) and triple contact (casks)	27-1-1904	28-1-1904	Nil	0·04	0·44	5 04	—	sl. alk.	
Precipitation (Lime) do.	26-2-1904	2-3-1904	Nil	0·87	0·71	10·36	—	sl. alk.	
Do. do.	29-2-1904	2-3-1904	Nil	0·22	0·38	5·48	—	50·9*	*Alkalinity as Na_2CO.
Do. do.	28-4-1904	28-4-1904	Nil	0·57	0·40	1·92	—	sl. alk.	
Precipitation (Lime), double contact (coal) neutralised with lime, two hours' contact and continuous filtration (casks)...	27-10-1903	29-10-1903	—	0·10	0·44	5·14	—	sl. alk.	

Ash Filter Effluents.

TREATMENT.	Date taken.	Date analysed.	Nitrogen. Nitric.	Nitrogen. From Free and Saline Ammonia.	Nitrogen. Albmd. (Wanklyn)	Oxygen absorbed in 4 hrs. at 80° F.	Acidity. When taken (to litmus)	Acidity. When analysed (as lactic acid)	Remarks.
Precipitation (Lime and double contact)..	14-9-1903	24-9-1903		0·04	1·23	14·12	v. slight	57·6	
Do. do. ...	22-9-1903	26-9-1903	—	0·09	0·56	4·72	Nil	30·6	
Do. do. ...	22-9-1903	26-9-1903	—	0·10	0·34	4·02	Nil	18·0	
Do. do. ...	21-10-1903	22-10-1903	—	0·30	0·86	12·48	slight	36·0	
Do. do. ...	27-10-1903	30-10-1903	—	0·40	0·65	4·88	Nil	16·2	
Do. do. ...	3-11-1903	9-11-1903	—	0·06	0·56	6·84	—	16·2	
Do. do. ...	12-11-1903	17-11-1903	—	0·34	0·48	4·62	Nil	sl. alk.	
Do. do. ...	18-11-1903	23-11-1903	—	0·26	0·65	6·24	Nil	16·2	
Do. do. ...	29-2-1904	3-3-1904	Nil	0·40	0·84	13·16	—	sl. alk.	
Precipitation (Lime and Aluminoferric) and double contact	19-11-1903	23-11-1903	—	0·20	0·48	7·66	Nil	25·2	
Precipitation (Lime and Copperas) and double contact	7-12-1903	14-12-1903	Nil	0·08	0·72	9·20	Nil	v. slight	
Do. do. ...	21-12-1903	23-12-1903	Nil	0·12	0·77	9·96	Nil	v. slight	
Precipitation (Lime, Copperas & Sodium Manganate) and double contact ...	18-1-1904	20-1-1904	Nil	0·10	0·41	6·68	Nil	slight	
Do. do. ...	9-5-1904	13-5-1904	Nil	2·32	0·45	5·80	Nil	v. sl. alk.	
Sprinkler Filter Effluents.									
Precipitation (Lime), double contact (ashes) and sprinkler filtration ...	11-11-1903	16-11-1903	—	2·22	0·48	3·32	—	sl. alk.	
Do. do. ...	12-11-1903	17-11-1903	—	1·14	0·32	2·86	—	sl. alk.	
Do. do. ...	18-11-1903	23-11-1903	—	0·12	0·34	4·30	—	sl. alk.	
Do. do. ...	26-2-1904	2-3-1904	Nil	0·08	0·44	8·90	—	sl. alk.	
Do. do. ...	29-2-1904	3-3-1904	Nil	0·04	0·46	9·86	—	42·4*	*Alkalinity as Na_2CO_3
Do. do. ...	28-3-1904	29-3-1904	Nil	0·86	0·20	1·76	—	sl. alk.	
Do. do. ...	28-3-1904	29-3-1904	Nil	Nil	0·27	1·92	—	sl. alk.	
Do. do. ...	27-4-1904	28-4-1904	0·20	0·29	0·24	1·62	—	sl. alk.	
Same as above (supplied intermittently to sprinkler), strained through sand...	28-3-1904	29-3-1904	Trace	0·06	0·12	1·46	—	sl. alk.	
Precipitation (Lime and Copperas) double contact (ashes) and sprinkler filtration	1-12-1903	4-12-1903	Nil	0·08	0·18	3·68	—	v. sl. alk.	
Do. do. ...	7-12-1903	14-12-1903	Nil	Trace	0·28	5·56	—	sl. alk.	
Do. do. ...	21-12-1903	22-12-1903	Nil	Trace	0·39	5·92	—	v. sl. alk.	
Same as above, strained through sand ...	29-12-1903	4-1-1904	Nil	0·24	0·18	1·82	—	sl. alk.	
Precipitation (Lime, Copperas and Sodium Manganate), double contact and sprinkler filtration	18-1-1904	19-1-1904	Nil	0·03	0·26	4·10	—	sl. alk.	
Do. with settlement of suspended matter	27-1-1904	28-1-1904	Nil	sl. trace	0·26	2·52	—	sl. alk.	
Do. strained through sand	18-1-1904	19-1-1904	Nil	0·04	0·25	2·76	—	sl. alk.	
Do. do. ...	9-5-1904	13-5-1904	0·24	0·03	0·06	1·18	Nil	sl. alk.	

Earth Filter Effluents.

Treatment.	Date taken.	Date Analysed.	Nitrogen.			Oxygen absorbed in 4 hrs. at 80° F.	Acidity.		Remarks.
			Nitric.	From Free and Saline Ammonia.	Albumd. (Wanklyn)		When taken (to Litmus).	When Analysed (as Lactic Acid).	
Precipitation (Lime), double contact (ashes), and earth filtration	24-2-1904	25-2-1904	0·73	0·14	0·24	4·64	—	sl. alk.	
Do. do.	26-2-1904	3-3-1904	1·00	Nil	0·26	3·86	—	sl. alk.	
Do. do.	29-2-1904	3-3-1904	Nil	Trace	0·32	6·60	—	59·4*	*Alkalinity as Na_2CO_3.
Do. do.	28-3-1904	29-3-1904	0·04	Nil	0·14	2·32	—	2·8†	†Alkalinity as Ca O.
Do. do.	27-4-1904	28-4-1904	0·30	Nil	0·15	1·61	—	sl. alk.	
Precipitation (Lime, Copperas & Sodium Manganate), double contact (ashes), and earth filtration	18-1-1904	19-1-1904	13·33§	Trace	0·11	2·94	—	sl. alk.	
Do. do.	27-1-1904	28-1-1904	2·29	Trace	0·13	2·00	—	v. sl. alk.	

§ The Filter was commenced on this date, and Nitrates about 10 parts per 100,000 were found in the soil used.

Analyses of Soil from Earth Filter.

(Results expressed in parts per 100 of soil dried at 100° C., except for moisture which is given in parts per 100 of soil as received.)

Nature of Soil.	Date taken.	Date Analysed.	Moisture.	Volatile Matter.	Mineral Matter.	Nitrogen.		Remarks.
						Total (Kjeldahl).	Nitric.	
From surface of Filter	6-4-1904	11-4-1904	34·13	13·6	86·4	0·38	Nil	
From layer one foot below surface	6-4-1904	11-4-1904	30·37	11·4	88·6	0·30	Nil	
Same as top soil originally placed in Filter..	6-4-1904	11-4-1904	25·69	11·9	88·1	0·32	0·010	

Mr. Ross (Burnley) said that Dr. Cowie had sent him some effluents from his experimental filters, but they were by no means satisfactory; they were certainly not purified sufficiently to enter any stream, especially those kept for fishing purposes. Dr. Wilson has suggested that he would have two percolating filters. Would it be any advantage to let the acid fermentation take place, and then to treat with lime afterwards when you get rid of more material, so to speak? He would like to know Dr. Wilson's experience in regard to distilleries.

Mr. Garfield (Bradford) said that some eight years ago he had put down plant in Staffordshire to deal with the refuse from a small brewery. The stream was a very small one, and the available fall was small. It was arranged that the whole of the brewery refuse should be treated together. It was treated with lime and copperas allowed to settle in the tanks, the clear liquid being filtered through a coal filter five feet deep. The rate of filtration through the filters was very slow indeed, he thought it was less than 50 gallons per square yard per day. The filtering material being fine the solid refuse collected on the surface, and men had to clean the surface of the filters constantly. The result was satisfactory to the County Council. He would like to point out that the brewery refuse was not such a strong one as had been spoken of.

Mr. C. H. Cooper (Wimbledon) thought that it would be interesting to know the amount of sludge that was produced from these works.

Mr. A. J. Martin (London) said he had felt the same apprehension which Dr. Wilson had expressed that the fermentation which took place in brewery refuse might hinder subsequent filtration. In one case of the kind where they were short of fall he had laid down a septic tank with a single set of contact beds. The filtered effluent was apparently inoffensive, but it went into a fairly large river, so that it was not watched so critically as it otherwise might have been. There was no trouble experienced there through the anaërobic treatment to which the liquid was subjected. One observation he had made which seemed to show that things were in a healthy state, namely, that the filtering material had no smell other than that of ordinary earth. He had taken the precaution of seeding the tank with the contents of a cesspool, and speaking from recollection he believed they took in the water closet and lavatory wastes from the brewery, which doubtless had some effect.

The President (Prof. Clowes) said that this was a matter of interest generally where the refuse from breweries is unmixed with other matters. In East London it had been said that they brewed far more beer than they did in Burton itself. He took it that the whole of that brewery waste went into their sewers mixed with other matters. They were unconscious of any difficulties in purification treatment arising from it. He did not know whether Dr. Wilson could tell

them what had been done at Burton. He remembered while living in the Midlands very unpleasant changes taking place in the River Trent immediately below Burton, but he supposed that state of things had been remedied. He did not quite understand what the function of the sand was; was it simply a clarifier, or did it produce some change other than the mechanical removal of suspended particles?

Dr. McLean Wilson (West Riding Rivers Board), in reply, said that they had in the West Riding all the kinds of liquid refuse in the kingdom, except that from distilleries. At present the question of purification of distillery refuse was being inquired into by the Royal Commission, and Dr. M. Gowan, their chemist, had been carrying out a series of laboratory experiments, and he had told him that his results were pretty much the same as those got from brewery refuse. As regards acid fermentation it went on for a long time, and the acid seemed to increase rapidly at first and then gradually decrease to the end of the second week. He had an objection to septic tanks because of the offensive smell, and he thought it would be impossible to have them close to the premises. A very important point in the treatment of brewery refuse, was the cooling or refrigerating water. If that was added it meant 80 per cent. of the total water discharged from the brewery, and it produced a liquid of much greater volume but very much easier to treat. Mr. Cooper had asked about the quantity of sludge. Unfortunately, while the tanks were used as septic tanks there was no record kept of the amount of sludge. The tanks had been cleaned out without notice being given to him, and no record was kept of the number of cartloads of sludge removed. After working ten weeks with lime he had the tanks cleaned out, and there were found to be nineteen cartloads of sludge. With regard to the final straining of the filter effluent through sand, that was done because he found the effluents from the percolating filters contained large quantities of suspended matter. The straining was very rapid, something like 500 gallons per square yard per day. At Burton he knew that the nuisance caused by the brewery refuse had been greatly lessened, although not altogether removed, by the extension of the sewage farm. All the brewery refuse was discharged into the town drains, large quantities of lime added, and the mixed sewage then carried on to the farm for irrigation purposes. One hundred grains of lime were used per gallon.

THE SUGGESTED USE OF COPPER DRINKING VESSELS AS A PROPHYLACTIC AGAINST WATER-BORNE TYHPOID.

By S. RIDEAL, D.Sc.Lond., F.I.C. (Fellow);

And E. BAINES, M.B.Camb., D.P.H., Camb.

THE Department of Agriculture in Washington has recently drawn attention to a new method of treating water supplies, to prevent the growth of algæ and certain pathogenic organisms, by the addition of small quantities of copper sulphate. They have shown that different algæ can be killed by this reagent when added to the water in parts varying from 1 to 2,000, to so small a quantity as 1 in 10,000,000, in the case of *Uroglena Americana*. The anabænas, which are frequently a source of odour in water supplies, seem to be killed by a proportion of 1 in 3,000,000.

Perry and Adams, in the fourth report of the Rivers Pollution, Connecticut, have found that 1 to 200,000 is not injurious to minnows and goldfish; and, in general, animal life seems to be less susceptible to copper than plant life.

In this country, as is well known, the minority report as to the colouring of vegetables by copper agrees with that of Continental observers as to the harmlessness of quantities of copper for adults, even up to 1 gramme per day.

At Ben, in Virginia, in 1901, spirogyra, which had developed to such an extent in the water-cress beds as to seriously handicap the industry, was eradicated by the addition of 1 to 50 million parts of copper sulphate; and 1 in 4 million parts has also been effective against filaments of anabæna, reducing them from several thousand per c.c. to none.

As to the effect on pathogenic organisms, this has been studied by Kroncke, Schumburg, Green, Leveson and Slater, Vincent, and other investigators (see Rideal, "Disinfection and Disinfectants," pp. 156 to

160): but most of the authorities seem to have advocated very much stronger solutions than those which have been found effectual for killing algæ.

It was thought, therefore, of interest to carry out further experiments with copper sulphate and copper chloride with specific pathogenic organisms. The results have been as follows:—

A 1 per 1,000 solution of copper sulphate was made by crushing the crystals and pressing the powder between blotting-paper, and dissolving in distilled water. (This solution was subsequently found to contain 1 part of Cu in 3,825.)

A 1 per 1,000 solution of copper chloride was also made, by drying the crystals at 100° C., and using the brown powder. This was found to contain 1 part of Cu in 2,600—*i.e.*, nearly twice the amount in the copper sulphate solution.

TABLE I.

B. Coli with $CuSO_4 5OH_2$.

	Distilled water. Boiled.			Tap water. Filtered.		
	1 hour.	3 hours.	20 hours.	1 hour.	3 hours.	20 hours.
1 in 1,000 (=1 in 3,825 of Cu)	—	—	—	—	—	+ (?)
1 in 10,000	+	+	—	+	+	—
1 in 100,000	+	+	+	+	+	+
1 in 200,000	+	+	+	+	+	+

? Reinfection.

B. Coli with $CuCl_2$.

	Distilled water.			Tap water.		
	1 hour.	3 hours.	20 hours.	1 hour.	3 hours.	20 hours.
1 in 1,000 (=1 in 2,600 of Cu)	—	—	—	—	—	—
1 in 10,000	+	+	—	+	—	—
1 in 100,000	+	+	+	+	+	+
1 in 200,000	+	+	+	+	+	+

B. Typhosus with $CuSO_4 5OH_2$.

	Distilled water.			Tap water.		
	1 hour.	3 hours.	20 hours.	1 hour.	3 hours.	20 hours.
1 in 1,000	+	—	—	+	—	—
1 in 10,000	+	—	—	+	—	—
1 in 100,000	+	+	+	+	+	+
1 in 200,000	+	+	+	+	+	+

B. Typhosus with $CuCl_2$.

	Distilled water.			Tap water.		
	1 hour.	3 hours.	20 hours.	1 hour.	3 hours.	20 hours.
1 in 1,000	—	—	—	—	—	—
1 in 10,000	—	—	—	+	—	—
1 in 100,000	+	+	+	+	+	+
1 in 200,000	+	+	+	+	+	+

From this first set of experiments one learns that with copper sulphate (1 in 5,000 copper in solution) a contact of one hour is not quite sufficient to insure the death of B. typhosus, but kills B. coli.

Similarly with copper chloride, 1 in 26,000 kills coli in three hours and typhoid in one hour.

It would seem from this fact that the chloride is the more active salt.

Comparing the results of the sulphate and chloride on B. coli, it will be seen that 1 in 10,000 of the chloride killed in one hour; but that more than 3 hours were required with 1 in 10,000 of the sulphate. This shows that for equal weights of the salts the chloride is more efficient, but as the actual amount of copper in the two solutions was in the ratio of 3,825 to 2,600, it would seem from this preliminary experiment that the efficiency is roughly dependent on the absolute amount of ionic copper present.

This hypothesis was proved to be correct by a further experiment carried out on B. coli. The strengths of the two salts required to kill the bacillus in 3 hours were found to be between 1 in 8,000 and 1 in 9,000 of copper sulphate; and 1 in 13,000 and 1 in 14,000 of copper chloride, corresponding in each case to a percentage of about 0·003 of metallic copper.

With Staphylococcus pyogenes aureus: this organism was similarly killed by less than 2 hours' contact of 1 in 7,000 of both copper sulphate and copper chloride. With the chloride, stronger in copper, even a solution of 1 in 10,000 was efficacious.

Even metallic copper, in presence of water, produces a so-called colloidal solution, which according to Nägeli, Galeotti, and Israel and Klingman, is sufficient to make the water toxic to many forms of algæ and bacteria.

The Department of Agriculture has shown that an area of about 1 sq. cm. to each 100 cc. of water is sufficient for exterminating uroglena and some forms of spirogyra from a reservoir, and suggests that this quantity would also be effective in diminishing the number of pathogenic organisms

present, so much so that water standing for 6 or 8 hours in a clean copper vessel, at room temperature, should be free from any cholera or typhoid germs.

We have carried out some further experiments in this direction, using copper foil, as follows:—

Experiments with Copper Foil.

Five flasks were sterilised with 100 cc. of water in each, and into three of them 50 sq. cm. of copper foil were introduced (giving 100 sq. cm. of surface). The other two flasks served as controls. Each flask was inoculated with a single loopful of the test organism, and subcultures were made, at once, in 2½ hours, in 6 hours, and in 24 hours. The following are the results:—

	Cu + B. Coli.	Cu + St. Py. Au.	Cu + B. Ty.	Control + B. Coli.	Control + B. Typh.
At once—					
$\frac{1}{1000}$ cc.	+	+	+	+	+
$\frac{1}{10000}$ cc.	−	−	+	+	+
2½ hours—					
$\frac{1}{100}$ cc.	+	+	+	+	+
$\frac{1}{1000}$ cc.	−	−	−	+	+
6 hours—					
$\frac{1}{10}$ cc.	−	−	−	+	+
$\frac{1}{100}$ cc.	−	−	+	+	+
24 hours—					
1 cc.	−	−	−	+	+
$\frac{1}{10}$ cc.	−	−	−	+	−

These experiments are only preliminary, but seem to warrant us in concluding that exposure of water, which is open to contamination, in clean copper vessels for less than 24 hours would be sufficient to render it safe for drinking purposes.

We are therefore able to confirm the suggestion put forward by the American workers, and we hope that the old-fashioned prejudice against the use of copper vessels for food or drink, will, in the view of this recent literature, not militate against a prolonged trial of what seems to be a simple method of reducing the dangers of infection of water-borne typhoid.

We are also trying the effect on sewage filtrates of passing them through copper gauzes, to reduce the number of pathogenic organisms therein, with a view to protecting water-cress beds and oyster layings.

Further observations were made on the green growths from London tap water, with strengths of the two salts varying from 1 in 2,000 to 1 in 5,000,000. After 13 days' contact the bottles containing the stronger solutions showed a deposit of basic copper salt, the weaker showed no change.

Under the microscope the more typical specimens were examined, in comparison with an untreated sample, in which protococcus and scenedesmus were the predominant species. The strong solutions seemed to make the cell contents more granular and of a less vivid green; but with a dilution of 1 in 10,000 the change was not marked.

It was further noticed that the protococcus forms seemed to be more predominant in the presence of the weaker amounts of copper, pointing to the conclusion that it was more easily attacked than the scenedesmus forms.

The President (Prof. Clowes) said they were satisfied it would hardly be safe to feed watercress beds with polluted water, even after it had been treated with copper. They were examining the matter in London, and they had every reason to believe that a large amount of the watercress which came into London was fed with water of somewhat doubtful origin. It would be a serious matter to consider that water was rendered safe by any treatment of the sort suggested in the paper; an unpolluted water should be used.

Mr. C. H. Cooper (Wimbledon) said that if they considered the water they drank in London, it was certainly of doubtful origin. He had noted daily a water supplied by one of the large companies which gave an amount of oxygen absorbed which was often more than that of the effluent from Wimbledon sewage. If anything could be done in country districts to guard against pollution getting on to watercress beds it would be a good thing.

Dr. Hoey writes as follows: It is remarkable that the most recent scientific research should tend to show that copper in any form is destructive of any pathogenic organisms, because I have observed that some classes of the native population in India use copper vessels for drawing and storing water and for drinking purposes. It has occurred to me since I read the paper that this practice, of which I did not know the possible significance while I was in India, might be found to have had its origin in either crude observations or scientific knowledge of ancient date. It would be interesting if we could obtain accurate information on this point; but it would be valuable, from your point of view, if it could be ascertained that any immunity from disease not enjoyed by those who, in India, use brass, iron, or earthen vessels, can be observed to be posseessed by those using copper utensils. I propose that information should be collected on these points, and I shall see what I can do to assist. Europeans in India use copper pots for cooking purposes, but have them coated periodically with tin, so European usage in India is no criterion. The point relevant to your inquiry is the extent to which natives use copper vessels in connection with the collection and storage of water without coating them with tin or other material, and whether that use is based on any popular belief in, or any specific observation of, their hygienic efficacy.

A NEW PHYSIOLOGICAL METHOD FOR THE DETECTION OF SEWER GAS.

Preliminary Note

By S. RIDEAL, D.Sc., F.I.C.

(Fellow.)

IN the course of an investigation into the influence of various gases on blood pressure with Dr. Oliver, of Harrogate, through the kindness of Mr. Maurice Fitzmaurice, the chief engineer of the London County Council, I carried out a series of experiments on the influence of sewer gas on the arterial blood pressure of workmen exposed to the air of the Lupus Street sewer, on December 18th, 1903.

Experiments on sewer gas have hitherto been confined to the determination of the number of organisms present, and the amount of carbonic acid; but it is evident that from these determinations little useful information is arrived at.

A few animal experiments have also been conducted, amongst these those by Dr. Barker, who exposed dogs to the air of a cesspool in a box, and found that they suffered from vomiting, purging, and a febrile condition "resembling the milder forms of continued fever, common to the dirty ill-ventilated homes of the lower classes of the community." From this experiment he concluded that the hydrogen sulphide and ammonium sulphide present in the cesspool gases caused the ill-effects, and not the organic matter also present in the air.

Dr. Alessi, in 1894, in his well-known investigation, also experimented on the effect of putrid gases on animals, including sewer gas, and was of the opinion that the predisposition to infection was acquired more easily during the first two weeks of exposure to the sewer gases, but that the putrid gases experimented with, viz., retinindol, ammonia, hydrogen sulphide, methyl sulphide, carbonic acid, carbon monoxide, ammonium sulphide, taken separately, and even some of them when mixed, do not predispose

animals to typhoid infection. He therefore concluded that predisposition to infection is due to the combination of gases given out by putrid fermentations, and not to any one of them separately; and that this predisposition is diminished by prolonged breathing of the mixture.

Mr. Roechling ("Sewer Gas and Health"), 1898, also has summarised some of the more important cases of death from sewer gas poisoning, and also cases where typhoid fever and blood poisoning have been traced to sewer gas.

In the course of the investigation, already referred to, with Dr. Oliver, I noticed that carbonic acid, in proportions of 10 to 20 volumes per 10,000, has a very marked effect on the arterial blood pressure, causing it to rise from the normal of 100 mm. of mercury to 115 or 120, and even to 130 mm.; but that on the removal of the carbonic acid, the pressure at once returns to the normal.

Carbon bisulphide, similarly, increases the blood pressure temporarily; whilst ammonia has a depressing influence.

Carbon monoxide resembles carbonic acid, but much smaller quantities are detected by this test.

In no case, however, did any of these gases produce a permanent alteration of blood pressure. The pressure quickly returned to the normal, on the subject's leaving the experimental room, except in the case of carbon monoxide, when the recovery was somewhat delayed.

At the Lupus Street sewer, however, the sewer gas behaved differently. The carbonic acid was determined simultaneously at different parts of the sewer, and found to be 9·0, 9·3, and 9·7 volumes per 10,000. Three sewer men who had been accustomed to work in the sewers for some years, were exposed for over 3 hours to the sewer gas, and their arterial pressures, on coming to the surface at noon, instead of being normal were 115, 115, and 112 respectively, and their blood pressures did not fall to the normal for over half-an-hour's exposure to fresh air.

Seven men who had not been exposed to any sewer gas during the day, and who had an average arterial pressure of 100 mm. of mercury, then went down the sewer for about half-an-hour. On returning to the surface their average pressure was found to be equal to 113 mm. of mercury; so that the sewer gas, even for a short time, caused a considerable rise in the arterial pressure. In addition to this alteration, it was further noted that the hands were red, showing congestion of the capillaries; that the veins were reduced in size, or were not apparent; and that the pulse rate was accelerated.

It is therefore evident that exposure to sewer gas, even for a short

time, increases the blood pressure, and unlike carbonic acid the increase of pressure so produced remains for a considerable period, after the cause is removed, by exposure to fresh air.

It is possible, as already mentioned, that this continuance of high pressure after exposure to sewer gas may be attributable in part to the presence in it of carbon monoxide; but these preliminary experiments seem to indicate that some other factor must be contributing to the phenomenon.

I am at present pursuing these experiments, as I believe that this method of research will enable one to diagnose sewer gas, not only from other gases with a carbonic acid content, but will help to elucidate the problem as to the constituents of sewer gas which are the predisposing factors.

The President (Prof. Clowes) said he could not help thinking that the method proposed by Dr. Haldane, which enabled the blood to be examined not only at once, but after a long period, was superior to that suggested by Dr. Rideal, which could only be made on the subject at the time. Any enlargement of their knowledge as to methods of detection was, however, of importance.

CONGRESS AT GLASGOW.

JOINT MEETING OF SECTIONS II. & III.

STANDARDS OF PURITY FOR SEWAGE EFFLUENTS.

By Prof. Dr. DUNBAR (Hamburg).

AFTER many years of fruitless research we believe that we have at last found means to insure thorough purification of town and trade sewage, even in cases where approved methods, such as irrigation or intermittent filtration are not applicable.

Almost all those who are interested in the endeavours to keep our rivers clean, or to make better the intolerable condition in which many rivers are at present, have set their hopes on the biological methods of sewage purification.

Whenever, in the course of passed decades such hopes were inspired by any new promising schemes, endeavours were revived to determine reliable principles for testing the efficiency of the new methods of sewage purification.

At first sight it does not appear to be so very difficult to decide whether a certain sewage or effluent is in such condition that it might safely be let into the river. What we aim at is, that the beds and banks of our rivers are kept free from foul sediments; that the water of our public water courses does not become turbid, discoloured, and foul, and that such water sustains fish life.

In some cases other requirements must be enforced, for instance, sometimes it is essential to maintain the river water in a condition suitable for utilisation for domestic supply; sometimes factories discharge only their refuse water into the river, others utilise the river water for manufacturing purposes, and require that not too much condensed or other hot waste water is discharged into the river, also, that the river water remains soft, and is not spoiled for their purposes by admixture with injurious chemicals.

It is not necessary in all cases to fulfil every one of the requirements. Often only one or two of them must be considered.

The greatest difficulty in our question arises from the variability of the proportion between the quantity of sewage and that of river water, into which the former can be discharged.

In one case we can let crude sewage into a stream without having to fear that the slightest detectable alteration of the river water will result. In other cases offensive changes of the river water can only be avoided by purifying the sewage very thoroughly before discharging it into the river.

These facts show the hopelessness of all endeavours to find one standard which would suffice for all cases.

As long as we do not drop the idea that the admissibility of crude sewage or effluents into rivers may be judged by standards based exclusively on the chemical or physical nature of the sewage or effluent, we can never hope to come to decisions that are just and rational. The only possibility in this line would, according to my idea, be to succeed in finding a series of standards permitting us to individualise and to arrange matters so as to allow us to easily determine the standards best adopted to the local conditions of each case; in fact, things will never work satisfactorily if authorities are allowed rigidly to enforce a single standard or set of standards for all cases. We need the expert in every case.

It would therefore be a mistake to search for a reaction that would enable us in one and all cases to affirm whether a certain sewage or effluent is fit to be discharged into the river or not. Such a reaction indicating whether the effluents are sufficiently free from albuminous substances, or from certain products formed in the decomposition of proteids, could come in question in such case only where a thorough purification of sewage seems necessary.

It is not my intention to formulate definite propositions as to how many standards or classes of requirements would seem to be necessary, and what requirements ought to be made for the different standards or classes. I shall limit myself to the discussion of one question of fundamental importance, namely: Does what we know of sewage analysis to-day put us in a position to judge, from the results of chemical investigation, whether a certain sewage or effluent tends to undergo putrefaction or not? Of course there are cases where nuisance does not so much consist in putrefaction, but the waste water contains inorganic poisonous substances or chemicals influencing detrimentally the physical qualities of the water, or coal dust or other mining refuse destroys the appearance of the rivers; such difficulties, however, only arise in certain relatively small

districts. Town sewage, or such factory waste waters as contain putrescible matter, are of far greater general importance. At any rate, I shall have to limit myself to the discussion of these latter to-day.

The questions connected with the elimination or destruction of pathogenic germs from sewage I will not enter into. Not because I do not find them ripe for discussion. On the contrary, my opinion is that an efficient disinfection of sewage can be easily accomplished together with biological purification; but according to my idea the question of sewage purification ought to be treated apart from the question of sewage disinfection. Nor shall I enter into the much-discussed question: in what proportion crude sewage may be admixed with river water without creating a nuisance, but will in connection with this point only say, that real crude sewage ought never to be discharged into a river at all—the suspended solids should be in every case previously removed as efficiently as possible. Exceptions should only be made in those very rare cases where unusually favourable conditions prevail.

I have no doubt that in those cases, where sewage has to be purified, we shall more and more come to carry this purification out in two stages: namely, first stage, elimination of the suspended solids; second stage, removal or destruction of the dissolved impurities.

According to this view I further limit my subject, and shall only speak in the following paragraphs of sewage freed from suspended matter. Therefore I modify my question as follows:—

Are we enabled to judge by the results of chemical analysis whether a certain sewage freed from suspended matter, or a certain effluent, tends to putrefy?

To answer this question several methods have been suggested, all of which were intended to give information as to the amount of putrescible substances contained in a certain sample.

For a long time extensive use has been made of the oxygen-absorption test. This method is founded on the observation that organic substances have a great affinity to oxygen.

Here, in Great Britain, the albuminoid ammonia test is largely used.

In Germany, the determination of organic nitrogen is preferred, as it is believed to give more accurate results than the albuminoid test.

Lately, J. König has recommended an improved method for the determination of organic carbon, which is said to indicate also those putrescible organic substances which, being more resistant to decomposition, are not indicated by the methods mentioned before.

Still, not one of these methods can be expected to give perfectly

accurate results. For the requirements of ordinary practice such exactness cannot be expected, nor is it necessary, since sewage—either domestic sewage or trade refuse—contains the most heterogeneous substances in quantities varying from minute to minute.

The question therefore seems justified, whether the more simple methods would not suffice in common practice as well as the more complicated ones. Further on I hope to convince you that this really is the case.

Not long ago it was quite common to ignite the solid matter, and to reckon the loss on ignition as organic matter. Even nowadays we find reports based on this method of the determination of organic matter. Evidently, we cannot expect to get reliable results with regard to the amount of organic matter contained in sewage by this method. By ignition, ammonium salts, nitrites, nitrates, and sulphates, and eventually also alkaline chlorides are decomposed and evaporated. The loss of weight caused by the breaking up of such inorganic matter figures as organic substances. By adding carbonate of ammonia, or water containing carbonic acid, these losses cannot be exactly compensated.

By determining the loss on ignition, therefore, satisfactory results with regard to the amount of organic substances in sewage are not obtainable.

Much less can we by this method specify the different organic substances or determine their relative quantities. Nevertheless, even this method is, as we shall see further on, not entirely useless.

The determination of oxygen absorbed is also incorrect, in so far as not only organic but also certain inorganic matter is indicated by this method. Permanganate of potash is decolorised by ferrous salts, nitrites, sulphites, sulphides, ammonia, etc. Furthermore some organic bodies are very easily oxidised, others only after exposure to boiling point for several hours. On the other hand the organic substances do not absorb oxygen in proportion to their molecular weight. More especially some substances most characteristic of sewage, such as uric acid, absorb very little oxygen in proportion to their weight. Lastly, the determination of oxygen absorbed is not made uniformly, but in very different ways. Some analysts effect the determination in alkaline, others in acid solution, some at room temperature, others at boiling point, some boil for three minutes, others for five, others for ten minutes. Some filter the sewage in order to eliminate the suspended matter, others examine without filtration.

It is evident, therefore, that results gained in such different ways are not comparable.

It is also clear that we cannot find out by the method in question any details as to the nature and relative quantities of the different organic

substances present. Notwithstanding all these deficiencies, I shall, later on, have to attribute an importance to the determination of the oxygen absorbed.

The determination of albuminoid ammonia is a British method, and is, as above mentioned, used mostly in Great Britain. Its chief recommendation is that by this method only the proportion of organic substances containing nitrogen is indicated, and to such substances the objectionable putrefaction is alone attributed. I cannot quite agree with this last opinion. It will suffice to mention the foul odour of sulphuretted hydrogen and of some carburetted gases, as well as of some fatty acids, etc., which are formed in decomposing sewage, in order to justify my opinion that we ought not to keep in view only the determination of nitrogenous organic matter.

On the other hand, the nitrogenous organic substances evolve albuminoid ammonia in varying quantities. We cannot, therefore, draw any conclusions by the results thus obtained as to the nature and relative quantities of nitrogenous organic substances.

The determination of albuminoid ammonia is also made in different ways. Some boil, after addition of magnesia, in order to first remove free and saline ammonia. Thus part of the albuminoid ammonia is lost. But this loss may, as you know, be avoided by making a separate determination of the free and saline ammonia.

Albuminoid ammonia is always present in very minute and variable quantities in sewage and sewage effluents. The slightest experimental error can therefore easily lead to differences of 100 % or more in the calculation of the results.

For these and other reasons this method has not found favour in German laboratories. In Germany the determination of organic nitrogen has, as mentioned before, been preferred within recent years. This determination of organic nitrogen has also its drawbacks. By this method, too, those substances that escape by boiling with magnesia are counted as free or saline ammonia, although the free and saline ammonia figures are far higher when determined by distillation than when measured by Armstrong's colorimetric method without distillation. Moreover, this determination again only indicates nitrogenous substances, but no other putrescible matter, and lastly, the results obtained represent only minute quantities. Aside therefrom, this really complicated method, which requires a great deal of time, leads to reliable results only in the hands of very careful chemists, especially experienced in this line of investigation.

According to my idea, the determination of organic carbon by J. König is far more useful than any of the methods mentioned above. Still, even

this method does not permit us to judge what kinds of organic bodies are present, and in what proportions. But König's method requires less time, is sufficiently simple, and, what is most important, the results are determined by means of balances.

After these explanatory statements I will now return to my question, whether by chemical analysis we are enabled to decide with certainty whether a given sample of sewage or effluent is liable to putrefy or not.

According to my view this question can be answered in the affirmative in all those cases where we have to do with samples containing very small quantities of organic substances, as indicated by one of the above-mentioned methods.

If, for instance, in a certain sewage or effluent we find a loss on ignition amounting to not more than two or three grains per gallon, or if we obtain an oxygen-absorbed figure, as indicated by Kubel's method, of not more than about one or two grains per gallon, or by the four hours' test an absorption of oxygen amounting to not more than 1 grain per gallon, or albuminoid ammonia equivalent to ·1 grain per gallon, or organic nitrogen of approximately ·2 grain per gallon, or organic carbon about 1 grain per gallon, we can almost positively say that these samples will not undergo putrefaction.

Are we now to understand that every sewage or effluent that contains a quantity of organic substances more or less exceeding these figures is liable to putrefaction?

The ingenuity and infinite pains which our leading men have brought to bear on the improvement, and on raising the accuracy of the methods in question, will, according to my idea, have brought us to a satisfactory end only if from the absolute figures obtained we are enabled to say with certainty whether any given sewage or effluent is liable to undergo putrefaction or not.

I am sorry to say that expectations in this direction are not justified. In order to substantiate this statement I should like to give you some data out of the investigations that have been pursued in this direction in the Hygienic Institute of Hamburg.

A certain crude sewage contained 10·4 grains per gallon of organic nitrogen; after undergoing biological treatment, the effluent contained 3·55 grains per gallon of organic nitrogen. This effluent was free from smell and did not undergo putrefaction.

Another sample of crude sewage contained 5·49 grains per gallon of organic nitrogen, the effluent obtained from it after biological treatment showed 2·19 grains per gallon and was not putrescible.

A third sample of crude sewage contained 2·10 grains per gallon of organic nitrogen. Although this crude sewage, therefore, did not contain more organic nitrogen than the just mentioned effluent, it became intensely putrid. After biological treatment it gave an effluent with ·67 grain per gallon of organic nitrogen, and this effluent was free from smell and did not putrefy.

A fourth sample of crude sewage, containing ·63 grain per gallon of organic nitrogen, was putrescible; after biological treatment it gave an effluent with ·24 grain per gallon that was free from smell and did not undergo putrefaction.

Every chemist engaged in sewage analysis will find among his analyses cases similar to these. I hardly need mention that you will not only find such results by comparing the organic nitrogen, but also by comparing the results of the determinations of organic carbon, albuminoid ammonia, absorption of oxygen, and loss on ignition.

These instances put beyond any doubt that by using the absolute figures obtained by the methods known to-day, we are not always in a position to affirm whether a certain sample of crude sewage or effluent will putrefy or will under given conditions create a nuisance in a river.

In England, standards have been published by some Rivers Boards according to which sewage effluents are considered bad if they contain more than ·1 or ·112 grain per gallon of albuminoid ammonia, or if they absorb more than 1 grain per gallon of oxygen as determined by the four hours' test.

We may safely assume that these committees have laid down such requirements, because they are convinced that any sewage or effluent in which albuminoid ammonia or oxygen absorption exceeds those figures will tend to undergo putrefaction. Now it is a fact, that from very concentrated sewage we are able by means of biological treatment to produce an effluent clear, limpid, colourless, and free from odour, which will under no circumstances undergo putrefaction, yet which will give far higher albuminoid ammonia figures, for instance, ·3 or even more grain per gallon of albuminoid ammonia, or will absorb, as determined by the four hours' test, far more oxygen than is allowed by the above-mentioned standards.

I have brought with me a sample of effluent which absorbs 6·8 grains of oxygen per gallon determined by the four hours' test, that is to say, about the same amount of oxygen absorbed by the crude sewage of Manchester, not freed from suspended matter by filtration. Moreover, you see here samples in which ·3 or even 1·37 grains per gallon of albuminoid ammonia have been determined. That is to say, several times the amount of

these substances allowed by the standards in question. These samples of effluents are so clear, colourless, entirely free from stench and non-putrescible, that the commissioners would doubtless be very pleased if all effluents let into their rivers were equally good.

How are we to understand these singular facts? According to my view, it would be a mistake to think that by biological sewage purification only about threequarters of the soluble organic matters present are entirely removed from the sewage, the remainder staying unaltered in the effluent. We have good reasons to believe that, by biological treatment, the entire organic matter present in crude sewage is retained and decomposed. If, therefore, a crude sewage contains, say, about 3 grains per gallon of organic nitrogen, the effluent 1 grain, we must not believe that about one-third of the organic substances containing nitrogen had passed the plant unaltered: but we may suppose that, with the exception of those substances unusually resistant to decomposition and, therefore, not liable to putrefaction, all of the organic matter has been decomposed, and that those substances giving the reaction of 1 grain per gallon of organic nitrogen are entirely different substances, not liable to undergo putrefaction.

The effluents from biological plants always contain substances which, determined by the methods spoken of, are called albuminoid ammonia, organic nitrogen, organic carbon, etc.

If, for instance, the crude sewage freed from suspended matter contained 6 grains per gallon of a certain substance, we find in the effluent from a biological plant in good working order about 1·5 to 2 grains per gallon; if the crude sewage contained 4 grains per gallon of the same substance, we find in the effluent 1 to 1·5 grains per gallon, and so on in proportion to the concentration of the crude sewage.

If we make all the determinations spoken of in one effluent we generally find the percentage of reduction to be the same or about the same in all the different determinations. This observation has been made so often and on such different sorts of sewage and effluents that a few years ago Dr. Thumm and I came to the conclusion that any one of the methods described would give almost equally reliable results as any of the other methods, and that, therefore, it would in general practice suffice to use the simpler methods only, as for instance the determination of oxygen absorbed.

But the substances indicated by our methods in the effluents are not identical with the organic putrescible matter contained in the crude sewage. These substances certainly contain nitrogen and carbon, but they are products of decomposition fully oxidised and non-putrescible. Therefore it ought to be of very little consequence whether the effluent contains

·1 or ·2 grain per gallon, or even several times as much of these substances as indicated by the albuminoid ammonia test, or whether we find 1 or 2 grains per gallon of oxygen absorbed or even much larger amounts, as long as these substances are non-putrescible and not harmful to fish even if they are placed into the concentrated, not diluted effluents. Such effluents should be considered as harmless and we ought not therefore to object to their being discharged into our rivers.

In a town with a relatively low water consumption we find comparatively concentrated sewage, and therefore in such case the absolute quantities of organic substances contained in a gallon of effluent will be higher than in the case of a town showing a larger consumption of water, and yet the effluent in the former case may be equally fit to be discharged into the river.

This sample (produced), for instance, is an effluent derived from town sewage treated biologically. Ought this effluent, looking nearly as clear and limpid as pure well water, and being absolutely free from any offensive smell and entirely non-putrescible, to be considered bad, and not fit to be discharged into a river because it absorbs 2·18 grains of oxygen per gallon determined by the four hours' test, or because it contains ·85 grain per gallon of albuminoid ammonia?

We come, as I have explained, to similar results by the determination of albuminoid ammonia, and of organic carbon. An excellent effluent may occasionally give figures by far exceeding those of a turbid, discolored, crude sewage tending to undergo putrefaction.

Every attempt to formulate standards based on absolute figures must appear hopeless in the face of these results which I have just laid before you, and are only extracts from a great number of analyses at my disposal, all tending to prove the same.

Although I admit that the standards mentioned before may suffice in the case of certain cities, it would, to my idea, be a grievous mistake to generalise them. In many cases, the effluents will just about not putrefy, if they contain ·1 grain per gallon of albuminoid ammonia, or if they absorb 1 grain of oxygen per gallon. But in many cases we can only get satisfactory information as to the putrescibility of the effluents if we also know the nature of the crude sewage.

With a moderate degree of certainty, we can by the appearance and smell of an effluent tell whether it will putrefy or not. But it must be admitted that this physical method of examination is not sufficient for all cases, and that even the judgment of a well-practised observer may be impaired by a cold or other indispositions.

The effluents when kept in a room in firmly-stoppered bottles for several days, will, if not thoroughly purified, develop a smell of sulphuretted hydrogen, and this can hardly escape our sense of smell, even in quantities far too small to be detected by chemical analysis. This method of examination, although leaving nothing to be desired as to its simplicity and reliability, is yet one of those subjective ones which we want to avoid, and besides that, it does not allow us to form a judgment before the lapse of several days. Now, in nearly all cases, it is most desirable that the efficiency of a purifying plant can be ascertained at any time and at once.

A few years ago, I observed when examining together with Dr. Thumm the effluents of biological purification works, that, when either the oxygen absorption (determined by Kubel's method) or the loss of ignition, or the organic nitrogen showed a reduction of at least 60-65 per cent. in the effluent as compared with the crude sewage freed from suspended matter, these effluents were not putrescible. Since then, I have made similar observations in regard to the reduction of organic carbon. I am not going to advance the statement, that this ratio holds good for every sewage and every biological system. Still, we have as yet regularly found it confirmed in every domestic and town sewage as well as in different trade wastes. I am therefore inclined to hope, that whereas absolute figures appear to be useless for our purpose, the percentage ratio between an effluent and the corresponding crude sewage may enable us directly to judge as to the putrescibility of that effluent. Fortunately we can in this case do without the above-mentioned complex methods, as the determination of oxygen absorbed gives us sufficiently reliable results.

Every one of the above-mentioned modifications of the determination of oxygen absorbed gives satisfactory results, if used for such calculation only. Of course, it is necessary always to examine the crude sewage and the effluent both in exactly the same manner.

Moreover, the above statements hold good only for sewage that has been freed from suspended matter. When examining the crude sewage unfiltered—as is usually done when making the four hours' test—the reduction is often found to amount to about 10 per cent. more than when comparing filtered crude sewage with filtered effluents.

To my idea, the examination of unfiltered samples is far more open to objection than the examination of filtered samples. The suspended matter in effluents of biological purification-plants is of an entirely different nature from that found in sewage.

The former consists, to a large extent, of animal and vegetable or-

ganisms, grown in the filter-beds, which should be regarded from quite a different point of view than the suspended matter in crude sewage.

The determination of oxygen absorbed is the simplest of all methods in question, and if Kubel's modification is employed, the results can be at hand within very few minutes. These, I think, are great inducements to the use of this test.

Concluding, I should like to state that, according to my opinion, we can judge the putrescibility of effluents better by the percentage of reduction effected by biological plants than by standards based on absolute figures.

CONCLUSIONS.

The absolute figures obtained even by the best methods of determining putrescible matter in sewage do not in all cases give definite indications as to the putrescibility of any given sample. Effluents of purification works may present a most satisfactory character, and yet under certain circumstances contain as large or even larger quantities of either organic carbon, organic nitrogen, or albuminoid ammonia; as high an oxygen absorption, and loss on ignition as samples of crude sewage which are in a high degree liable to undergo putrefaction. We should therefore, give up the attempt to find a standard of general applicability based on absolute figures.

A far safer judgment as to the putrescibility of effluents can be obtained by calculating the percentage of purification effected.

Simple methods like Kubel's oxygen absorption test give results entirely sufficient for practical requirements, if used only for calculating the percentage of reduction.

The analytical determinations spoken of are not needed in all cases. The requirement that all effluents should be absolutely non-putrescible, needs only to be made where the river presents most unfavourable conditions, or where the districts are densely populated.

In many cases it will be sufficient to require only that all coarser suspended matter be removed from the sewage.

In other instances all suspended matter, including finer particles, should be removed as efficiently as possible.

In other cases, again, the authorities will have to insist not only on the removal of the entire suspended matter, but also on a reduction of between 40 and 50 per cent. of oxygen absorbed by the dissolved impurities, the determination being made after filtering the samples; and there will certainly be such cases, too, where it must be stipulated, that the effluents are limpid and entirely non-putrescible.

It is desirable that leading men in Great Britain and Germany, where the great questions of rivers pollution and sewage purification are at present being discussed more than ever before, should come to an understanding to carry out the examination of sewage on the same lines. In such case the large amount of analytical work carried out in both countries every day, would lead to comparable results, and progress might be accelerated by mutual labour and interchange of ideas.

I should be happy if the paper which I am permitted to read before you to-day would help to bring us a step nearer to this end.

Statement of some of the Analytical Methods used for the Examination of Sewage Samples at the Hygienic Institute, Hamburg, that Differentiate from those in ordinary use in England.

Determination of Organic Nitrogen.

In this process the nitrates and nitrites are, by boiling with bisulphite of soda, perchloride of iron, and dilute sulphuric acid, broken up, the nitrogen being evolved as monoxide of nitrogen (N=O).

To 250 cc. of the filtered sewage or effluent are added 5 cc. of a 25 per cent.sulphuric acid, ·5 gr. bisulphite of soda, 5 drops of a 10 per cent. solution of perchloride of iron, and a small quantity of pumice stone; boil and evaporate to a volume of 50 cc. After the liquid has become cool, add 20 cc. pure sulphuric acid and ·1 gr. oxide of copper; 5 drops of a 10 per cent. solution of bichloride of platinum are added, and the fluid boiled until it becomes clear and light green. It is again allowed to cool, 200 cc. distilled water (tested to be free from ammonia) and 100 cc. of a 50 per cent. solution of caustic soda are added, and the ammonia evolved distilled into a measured quantity of decinormal sulphuric acid, as described above for the total nitrogen. The results obtained indicate the *sum total of organic nitrogen and the nitrogen of free and saline ammonia.* The latter is determined in a separate process (see under).

Frankland & Armstrong, *Jour. Chem. Soc.* (II.), Vol. VI., 1868, p. 77.

Ulsch, *Zeitschr. f. d. ges. Brauwesen*, 1886, p. 81.

Determination of Free and Saline Ammonia.

To 200 cc. of sewage or effluent add 4 cc. of a solution of caustic soda and carbonate of soda,* and mix thoroughly in firmly-stoppered cylinders;

*Dissolve 100 gr. crystallised carbonate of soda and 50 gr. caustic soda in 300 cc. distilled water, and boil until the liquid no more gives Nessler's test for ammonia; then make up for the loss of evaporation.

allow this mixture to stand for about twelve hours, until complete sedimentation has taken place. The supernatant clear fluid is then tested colorimetrically in Hehner's cylinders for ammonia by comparison with a standard solution of ammonium chloride, containing in 1 cc. ·05 mgr. NH_3. In one Hehner's cylinder a given quantity of the fluid to be tested (say 5 or 10 cc., according to the nature of the sample), in the other cylinder a corresponding quantity (say 1 or 2 cc.) of the standard solution of ammonium chloride, are filled up to 100 cc. with distilled water. To each cylinder 1 cc. of Nessler's solution is added and colorimetric comparison made.

Frankland & Armstrong, *Journ. Chem. Soc.* (II.), Vol. VI., 1868, March 6th.

Zeitschr. f. Analyt. Chemie, VIII., 1869, p. 353.

Determination of Oxygen absorbed (after Kubel).

In an Erlenmeyer flask of about 450 cc. capacity, freed from organic impurities by preliminary boiling with an acid solution of permanganate of potassium, 10 cc. of filtered sewage or effluent, 90 cc. of distilled water, 5 cc. of a 25 per cent. solution of sulphuric acid, and a trifle of pumice stone are heated over an open flame, until the liquid just begins to boil; then 15 cc. centinormal potassium permanganate solution are added, and the mixture kept boiling for exactly ten minutes, after which time, without allowing the fluid to cool, 15 cc. centinormal oxalic acid solution are run into the liquid, which immediately becomes decolorised; the surplus of oxalic acid added is found by titration against centinormal potassium permanganate. In case the mixture of sewage (or effluent) with permanganate should become decolorised during boiling, the quantity of the sample taken was too great, and it is necessary to repeat the determination with, say, 5 cc. of the sample and 95 cc. distilled water. The results obtained are most accurate if the amount of permanganate decomposed in the test does not exceed 12 cc., and is not less than 3 cc.

The titre of permanganate against oxalic acid being liable to certain variations, it must in every case be determined by a blank test with 100 cc. of distilled water. As commercial distilled water, however, usually contains organic impurities, these must also be determined in the blank test. The following example will serve to show how that may be done.

100 cc. distilled water are boiled with 15 cc. permanganate, mixed with 15 cc. oxalic acid and titrated against permanganate, as described above, thus giving an oxygen absorption of, say, 1 cc. permanganate. To the neutralised mixture 15 cc. oxalic acid are again added, and the liquid

titrated against permanganate for the second time. If, in the latter titration, 15 cc. oxalic acid are found to correspond to, say, 15·8 cc. permanganate, then the titre of the permanganate is *15·8*, whereas the first titration would have made it 15 + 1 = 16·0 cc. The difference, ·2 cc., represents the impurities of distilled water, and must be deducted.

If 10 cc. of sewage (or effluent) show an oxygen absorption of, say	8·8 cc.
then deduct	·2 „
Oxygen absorption (corrected) ...	8·6 „
Amount of permanganate originally added to sample .	15·0 „
	23·6 „
Deduct titre	15·8 „
	7·8 cc.

The factor for calculation is found by the following formula:

$$\frac{15{\cdot}0}{\text{titre}} \cdot 316 = \frac{4{\cdot}74}{\text{titre}}$$

In the example given above it is $\frac{4{\cdot}74}{15{\cdot}8} = {\cdot}300$. The amount of permanganate required by 10 cc. of sewage (or effluent), therefore, is

$$7{\cdot}8 \times {\cdot}300 = 2{\cdot}34 \text{ mgr. } KMnO_4.$$

Determination of Organic Carbon.

The principle of this method is to completely oxidize the entire organic carbon to carbonic acid gas, which is absorbed by weighed tubes filled with soda-lime. To 250 cc. of filtered sewage or effluent are added 10 cc. of 25 per cent. sulphuric acid, and the mixture is boiled for half an hour in a round-bottomed Jena flask of 700 cc. capacity, the reflux condenser being open. Thus the free and saline carbonic acid present in the sample is allowed to escape. The flask having become cool, 2 or 3 gr. pure potassium permanganate and 10 cc. of a 20 per cent. solution of mercuric sulphate are added, and the condenser is joined on to the Peligot tube filled with concentrated sulphuric acid. Connected to the Peligot tube is the following system of tubes:—

A U-shaped tube filled with chloride of calcium.

Two weighed U-shaped tubes, provided with ground-in stopcocks, containing soda-lime.*

* Soda-lime, or sodium hydro-oxide of lime.

A simple U-shaped tube, the left arm of which is filled with soda-lime, the right with chloride of calcium.

This apparatus of tubes having been joined on to the reflux condenser, the flask is gently heated up to boiling point. The steam evolved hardly passes the reflux condenser; any traces of water not stopped there are absorbed in the tubes. The carbonic acid gas is completely absorbed in the tubes. When no more gas bubbles are seen to pass through the tube, the stopcock of the separator funnel is opened and a current of air sucked through the flask and tubes by means of an aspirator for half an hour. This air is, before entering the apparatus, freed from carbonic acid gas by being passed through either a single tube filled with soda-lime, or a Fresenius drying cylinder filled with the same substance. Finally, the stopcocks of tubes are closed, and the tubes again weighed. Their increase in weight indicates the amount of carbonic acid evolved from organic carbon.

König, *Zeitschr. f. Untersuchung der Nahrungs- und Genussmittel*, 1901, p. 193.

MR. ROSS (Burnley) said he understood that the samples which Prof. Dunbar had shown were obtained from percolating filters, and he noticed in most instances that they were considerably decomposed. It had been stated that no less than 50 per cent. of this deposit consisted of organic matter, and therefore it was most important that a subsequent treatment should be made. But they had to consider the system used with reference to the standard which should be applied. In the case of intermittent contact, where they had a double contact, there was but a slight call upon the increase in purity of the effluent, and consequently they could find that with a double contact bed, if they were purifying a very strong sewage, they could in almost every instance get a non-putrescible effluent. He knew in Burnley they could exceed the standard and get this, although as a matter of fact they did not do so. There was practically no suspended matter in their final effluent, and there was no necessity to treat it over land or in any other way of that description. He noticed that in one of the samples there was practically no sediment at all, and it would be interesting to know why this was the case. As regards standards, he felt that most of the authorities were so constituted, and had such very hard-working common-sense men at their head, that if they left the chemist in charge of the works and the authority to discuss most points, they would come to a conclusion as to what was necessary in each case, and where they differed it might be arbitrated upon, and thereby great difficulties would be overcome. Everybody should have an automatic gauge to show how much rainfall there was at the time, so that the

authority with whom he was discussing the question should know exactly the dilution of the sewage and the consequent purity he might be called upon to expect.

Dr. McVail (County of Stirling) said that as he understood it, Prof. Dunbar's view was that instead of there being a chemical standard for the effluent there should be a standard of putrescence. He quite agreed. It did not seem to him to matter what amount of albuminoid ammonia could be got out by boiling the effluent with caustic potash. There was no boiling of it with caustic potash in the river into which it was discharged. The question was whether the sewage would putrefy or not. What they wanted was not a particular chemical composition, but that the sewage should not undergo putrefaction and should not be destructive to fish life.

Dr. Barwise (Derbyshire) remarked that the Derbyshire County Council had simply adopted a standard as a general guide, and if any authority produced an effluent which was in every way satisfactory but which did not comply with their standard, it would be a matter for them to discuss as to the reasons why it did not comply with their standard. He might say that up to the present time they had not any authority who produced a satisfactory effluent which did not comply with their standard. Their standard was simply a pious opinion. It suggested that a good effluent contained at least ·5 parts per 100,000 of nitrogen as nitrates, it said it should not contain suspended matter and not putrefy, and that albuminoid ammonia should not exceed ·1 parts per 100,000. But that was merely an opinion for the guidance of local authorities and their advisers. They had had effluents which would not putrefy but which were extremely unsatisfactory. They had had at one time an effluent from the Burton sewage farm which was very largely treated with lime and it was not a satisfactory effluent. On the advice of Prof. Dewar it was further treated and now it was satisfactory. With regard to suspended matter the effluent produced by Prof. Dunbar, which he held in his hand, would not be satisfactory for some of their rivers. Certain of their rivers were a source of income to the whole district round owing to fishermen coming to fish for trout, and in a trout stream this suspended matter would be most objectionable to the small fry. It would get on their external gills and choke them, and the authorities in those parts would not be satisfied with an effluent containing this suspended matter. At a previous discussion of that Congress a gentleman asked if the effluent from percolating filters did not always contain suspended matter, and it had been suggested by Mr. Ross that this was so. This he denied; there was practically no suspended matter in the effluents from a properly made filter. He agreed that suspended matter was quite 50 per cent. organic matter, but if it was placed under a microscope they would see that the organic matter consisted very largely of larvæ of gnats and flies, which passed up at the end of the drains and bred. If they had a filter with extensive perforated sides—quite useless, in his opinion—gnats and

flies would get into the bottom of the filter and they died and were washed away with the effluent. He admitted that was not the whole explanation, but it accounted for a great deal.

Dr. McLean Wilson (Wakefield) pointed out that in the West Riding of Yorkshire they did not advocate any fixed standards. He thought that Dr. Dunbar himself had exactly hit the point when he said, "We may safely assume that these committees have laid down such requirements, because they are convinced that any sewage or effluent in which albuminoid ammonia or oxygen absorption exceeds those figures will tend to undergo putrefaction." That was really the case, for they knew that if they got sewage effluents complying with these requirements then these effluents would not undergo putrefaction. But Dr. Dunbar rather shifted his ground in his paper. He began by stating that facts showed the hopelessness of fixing one standard, and there he (the speaker) entirely agreed with him, but at the end of his paper he suggested that a standard of percentage purification should be adopted. That, to his mind, was as hopeless as the other. He had under his supervision two large towns, the sewage of one was three times as strong as the sewage of the other, and they both discharged into the same stream. It would not be at all fair that one town should be allowed to discharge an effluent with 60 per cent. purification of the stronger sewage, while the other town was giving a 60 per cent. purification, of the weaker sewage, because the effluents would be very different in the two cases. Then again similar effluents discharged into a very small stream would produce very much worse effects than if they were discharged into a large river, and the question of putrefaction was not one altogether to be solved by laboratory experiments, although they were a guide. One must bear in mind the nature and the amount of stream water into which the effluents were to be discharged, as these factors had a great bearing on the amount of putrefaction which would take place. The question of the suspended matter carried away by the effluents from percolating filters was a very important one, and he entirely agreed with what was said by Mr. Halliwell at the previous day's meeting, that an objectionable amount of suspended matter was carried away through those filters. They knew in Leeds that the amount of suspended matter was enormous, and it was in a state like peat. It was found on examination not to consist to a large extent of organisms, but was apparently an earthy peaty matter. In Staffordshire and Derbyshire they were going in for percolating filters of very fine material, and he had little doubt in his mind that they were retaining suspended matter in those filters and that they would be faced with the drawback very shortly of the filter requiring renewal. He would be glad if Dr. Dunbar would add to his paper as printed in the official proceedings references to the papers and journals where the methods of analysis he had mentioned were given. The methods mentioned were certainly not familiar to him, and he expected that was the case with others, and it was very interesting to know the methods adopted by their co-workers on the Continent.

Mr. Halliwell (Blackburn) agreed entirely with Professor Dunbar as to the advisability of removing suspended matter, for there were grave objections to this matter. Many of the streams in Lancashire contained very little water apart from sewage effluents and manufacturing liquids, and on these streams were a number of weirs. These weirs, although of great use to the manufacturers, caused the deposit of suspended matter in the effluent. The suspended matter was a cumulative quantity, and in warm weather they found the rivers in a putrid condition, which he believed was entirely due to this suspended matter. For this reason it was very essential that the suspended matter should be removed as completely as possible. It was a matter which had attracted a great deal of attention in their river valley, for in that valley they had many works where percolating filters were used. They were made in all forms, but in every case they found a large amount of suspended matter; it varied in amount, but it was always present. For several months after the filters commenced work they saw very little, but after twelve months or so the amount increased. In Accrington the filters had been working five or six years, and the suspended matter was large. It was to a certain extent removed, but there was a quantity left. The suspended matter from the septic tank would come through the filter and should be removed afterwards. In contact beds it seemed to be retained in the bed.

Mr. Murray (Renfrewshire) said he would like to tell them how matters were dealt with in that part of the country. He had, after an experience of about thirty-five years, come to the conclusion that sewage schemes should be treated very much on the same lines as domestic water supplies. It was well-known that no water supply could be efficient without a large reservoir, not only in order to impound water against a drought, but also to allow any solid matter to precipitate. In a sewage scheme the tank liquified and precipitated all solid matters, and only liquified sewage should be carried to the beds. He had visited several works in Scotland, Ireland, the North of England, and a part of France, and thought that, speaking generally, sewage installations had not justice done to them. In his opinion precipitating tanks were not of sufficient capacity or area for the crude sewage, and the beds were therefore over-wrought. The first care of local authorities should be the health of the community, and the question of cheapness should be a secondary consideration. He was sorry to say, however, that a large number of committees looked first and foremost to the keeping down of the rates. In this way engineers were hampered very much in designing schemes, and the result was that they could not produce a satisfactory effluent. He quite agreed with Professor Dunbar, that if a uniform standard could be arrived at with regard to the prevention of putrefaction, it would be a good thing, and would solve many difficulties. He designed a little installation not far from Paisley, where the discharge into the burn was within 5 feet of the filter beds, it had been working for three or four years, and no putrefaction nor

any ill result had followed, and, so far as he knew, no complaints had been received from anyone. He attributed this very much to the ample capacity of the precipitating tank and the area of the beds.

MR. D. ARCHIBALD (London) was afraid that the standard suggested by Prof. Dunbar would not work in practice. He did not think the Thames Conservancy and the Rivers Board would accept percentages instead of actual results. With reference to standards, what was really wanted was the relation between the effluent which proceeded from a given works and the volume of water into which it was discharged. In the case of Glasgow, it was easy to turn the effluent into such a stream as the Clyde, and he should imagine that the state of the Clyde by the time it reached the sea would not be far removed from that of the effluent itself. In the case of small streams, it was a very great point as to the volume of stream into which the effluent was discharged, and if that could be put into the form of a ratio it would be of great assistance in all cases. Dr. Dunbar had mentioned a purification of 65 per cent., but that seemed to him rather a low figure. He knew a tank effluent which gave 80 per cent. of purification and no suspended matter.

PROF. DUNBAR: By the four hours' test?

MR. ARCHIBALD: By the albuminoid ammonia test; but even the oxygen test gave about 74 per cent. This tank effluent would purify another 60 to 70 per cent. on a very small single contact bed, and then he did not think there was much danger of putrefaction.

THE PRESIDENT said the impression produced on his mind by the discussion was that there was a general agreement that an effluent going into a stream should be freed from suspended matter, but that there should be no hard and fast line fixed with regard to the chemical quality of the effluent. It appeared also that people were coming more and more to consider the incubator test as an important practical test of the suitability of an effluent for passing into a running stream. If an effluent did not putrefy at a high summer temperature, such an effluent could not be objected to on the score of nuisance.

PROFESSOR DUNBAR said he did not make a difference between contact and intermittent beds and percolating filters, as they in Great Britain understood them. They were thinking of sprinklers for distributing sewage over coarse material, and he agreed with what was said of this system: that there was a great deal of suspended matter in the effluent, and if they made the filter fine the suspended matter would remain in the filters and they would get choked. But through certain other continuously working filters the effluent was nearly freed from suspended matter, and he had shown such samples. He had one there he obtained from a method he did not speak about because he devised it himself.

By distributing the sewage over a filter, built like a percolating filter but covered with very fine material, one could keep the suspended matter on the surface of the filter, and remove it from there later. He had entirely succeeded in doing this. Dr. Barwise thought there was too much suspended matter in the effluent produced for the fish. Well, he had taken samples which had more suspended matter than could be found in those he produced, and had placed delicate fish into them; he had given them fresh effluent every day, and had kept them thus for two years. They could have any quality of effluent according to the fineness or thickness of the layer on the filter. He had samples in which, owing to the fineness of the material used, there was no suspended matter; but what he pointed out was that they did not want such purity in every case, because it was always expensive but not always necessary. Mr. Archibald thought he wanted to suggest a percentage of reduction as a standard, but he meant to be more careful. He was not going to advance the statement that this ratio held good for every sewage and every biological system; but certainly he hoped to reach a more satisfactory standard by using the ratio of reduction, whereas he thought they would never come to a satisfactory end by using absolute figures.

SIX YEARS' EXPERIENCE OF THE SEPTIC TANK SEWAGE DISPOSAL SYSTEM AT BARRHEAD.

By WILLIAM SHANKS.

ABSTRACT.

EIGHT years ago, after considering various methods of sewage disposal, Barrhead Municipality decided to adopt the septic tank system. Works opened formally on 15th June, 1899, having been in use to a considerable extent for a year prior to that date. They were designed to serve a population of 10,000, with a maximum sewage flow of 400,000 gallons per day. The system deals with domestic sewage and a proportion of roof water only. Surface water and manufacturing effluents discharge direct into the stream. Works consist of two grit-chambers, four septic tanks, and eight filters. Total filtering area is about 2,540 square yards. Alternation of filters accomplished by means of the automatic gearing supplied by the Septic Tank Syndicate. A man is kept on the works, at a cost of £60 per annum, to keep the works in order, and to keep the gearing clean. Total cost of works about £6,776. Present sewerage rate is 10d., less than one third of which is applicable to purification works. Total working expenses (including man above referred to), repairs, etc., about £80 per annum. Assessable rental in Barrhead £33,000. The bulk of the rate is absorbed in interest and repayment of capital. After capital is repaid, sewage will be purified at something like ½d. per £ per annum. Works have not lost efficiency during the past six years. Surface of filters required occasionally to be broken up as scum gathers on the top. Septic tanks have never been cleaned out. At end of tanks next the filters there is a scum on top about one inch thick, at the other end no scum at all. Sludge at bottom of tank towards outlet end about three feet deep, at inlet end none at all. Road detritus not allowed to enter tank. Analyses given showing the satisfactory nature of purification, and continued efficiency of the works. Town Council of Barrhead perfectly satisfied with the purification.

[*For Discussion on this Paper see page* 636.]

RECENT EXPERIENCE IN THE TREATMENT OF MANCHESTER SEWAGE.

By GILBERT J. FOWLER, D.Sc., F.I.C.
(Member.)

AT the Congress of The Sanitary Institute held in Manchester, in July 1902, papers were read by Mr. J. P. Wilkinson and myself on the new works for the biological treatment of the sewage of Manchester.

Since that time considerable progress has been made in constructional work, and a good deal of experience in the management of large works has accumulated.

On being requested to furnish a paper for this Section, I felt that some account of the results obtained during the past two years would be more useful to the Section than a paper of a more general character. At the same time I hope that certain aspects of the subject will afford scope for discussion, more especially the question of cost, to which subsequent reference will be made.

Present State of the Works.

At the present time there are at Davyhulme 26 half-acre contact beds in operation, and about 9 acres more are complete and will be put into use almost immediately. The remaining 11 acres out of the total of 46 should be at work before the end of the year.

The whole 27 acres of storm-beds have been for some time in operation. Three new septic tanks are nearly complete, and progress is being made with the extension of the channel intended to convey the filtrate from the primary beds to a limited area of secondary beds.

At the present time two thirds of the sewage of Manchester, including storm-water, is purified, at any rate to the point of being rendered non-putrefactive.

Characteristics of Manchester Sewage.

Before describing the results which have been obtained, it will be well to emphasize certain characteristics of Manchester sewage.

Manchester sewage is pre-eminently a manufacturing sewage. That is to say, the trade effluents predominate over the domestic sewage in their effect on the composition of the mixture.

In Manchester sewage the permanganate oxygen absorption is much greater in proportion to the nitrogen figures than in domestic sewage. Judged solely on the nitrogen figures it would be called a dilute sewage.

The oxygen-absorbed figures are due largely to sulphocyanate present in ammonia recovery liquor and in the waste liquors from spent oxide washing. Many tar derivatives are also present in benzol washings, etc., and these tend undoubtedly to inhibit bacterial action, not to the extent of preventing it altogether but of retarding its development, so that septic tanks and bacteria beds take a considerable time to mature. This can easily be shown in the laboratory by taking two bottles of the same mixture made by adding a little septic sludge to sewage. If a small quantity of certain trade effluents be added to one of these, the rate of evolution of gas is much less at first in this sample than in the original mixture without the trade effluents. After some time, however, the rate of evolution of gas in the two bottles becomes equal.

This peculiarity of Manchester sewage must, I think, be borne in mind in judging of some of the results obtained; these are not always comparable with those found where sewage is mainly domestic or where the trade-effluents are of fermentable character. It goes far, I believe, to explain why such indifferent results have been obtained in the rapid continuous filtration of Manchester septic tank effluent through a medium of large size.

Further, in judging of the amount of sludge left in the septic tank, the large quantities of mineral detritus from the streets, and of iron compounds from various works must not be forgotten.

THE OPEN SEPTIC TANKS.

In the following table will be found details of the amount of sludge removed from time to time, and the percentage of water and mineral matter (in the dry sludge) present on each occasion.

It should be mentioned that the provision of submerged walls, forming chambers at the inlet ends of tanks 1, 2, 3 and 4, has greatly facilitated the removal of sludge from these tanks, as, apart from the quantities removed from the inlet chambers alone, the greater part of which can be made to flow by gravity to the ejectors, a large quantity of sludge can be removed without labour from the main part of the tank, by first emptying the inlet chambers and then opening the sludge outlets in the submerged

Table showing quantity and composition of Sludge removed from open Septic Tanks.

Date.	No. of Tank.	Amount.	Per cent. of Water.	Per cent. Residue on Ignition of Dried Sludge.
1903				
April 18th to 28th	2	3,500 tons	85	61
May 18th to 22nd	6	2,530 „	81	63
„ 28th	1, 3, 4 (Inlet Chambers)	644 „	86	64
June 13th to 17th	5	1,750 „	84	53
July 2nd to 13th	1, 2, 3, 4 (Inlet Chambers)	920 „	90	48
September 3rd	2 (Inlet Chambers)	240 „	86	51
October 26th	1, 2, 3, 4 (Inlet Chambers)	915 „	86	56
November 21sth to 24th	6	2,520 „	86	61
December 3rd to 9th	5	3,700 „	83	62
„ 14th	2	1,500 „	86	57
1904				
January 28th	1, 3, 4	2,860 „	85	56
		Total Sludge Removed 21,069 tons	Average 85	Average 59

wall for short periods at a time. The pressure of the water on the sludge forces a quantity of the latter out from the neighbourhood of the outlets. As soon as water is seen to pass out with the sludge, the outlet penstocks are shut down, and again opened when an hour or so has elapsed, giving time for a further quantity of sludge to settle down behind the outlet valves.

Thus, on January 28th, 1904, and succeeding days, 2,860 tons of sludge were removed from tanks 1, 3, and 4 in this manner without running off the water in the tanks.

The total amount of sludge obtained from the septic tanks during the year, viz., 21,000 tons, works out an average of six tons per million gallons of sewage passing through the tanks, as compared with 14 tons 10 cwts., which is the average amount of sludge per million gallons obtained by chemical treatment during the previous four years. In making this comparison, the increased density of septic sludge must, of course, be taken into account, the average being about 85 per cent. water, as against about 88 per cent. in the case of sludge from chemical treatment.

While there can be no doubt, therefore, by the use of septic tanks the amount of sludge to be dealt with as such is reduced, the determination of the amount actually disappearing by septic action is a matter of considerable difficulty.

From the foregoing table, *e.g.*, it will be seen that the greater part of the sludge, viz., nearly three quarters of the whole, has been removed from tanks Nos. 2, 5, and 6, and a portion of this quantity was removed more on account of convenience than from any real necessity.

Under all the varying conditions, according to which the tanks were worked last year, it has consequently not been practicable to carry out such detailed observations as were made in 1900, and it is doubtful whether, when operating on a large scale, it will be possible to reach definite conclusions on this point until after the lapse of a number of years, owing to the indeterminate amount of sludge left in the tanks each year.

THE HALF-ACRE BACTERIA BEDS.

Management of Beds.—In bringing new beds into work the endeavour has been to put no more upon them than they could efficiently deal with, gradually increasing the burden as analysis showed that nitrification was taking place, and the beds were becoming mature.

In estimating the quantity which could be put upon the beds, the capacity of the beds was always borne in mind. It is evident that with the large initial capacity of a new bed, one filling represents a much greater quantity of tank effluent than will be the case later on when the clinkers have settled down and the bed has become more mature.

It was found, however, that besides the quantity put upon the bed another factor had to be considered in the initial stages of working, viz., the length of time during which the bed was allowed to remain full. Owing to the indifferent results obtained from certain beds during the earlier stages of working, the experiment was tried in one case of submitting the tank effluent to a very long contact, up to twenty-four hours or even more, three fillings only during the week being allowed. A surprising amount of purification took place, and non-putrefactive filtrates were obtained, although but little nitrification took place. The time of contact was gradually reduced from twenty-four to twelve hours, then to six, and finally to two hours, which is the usual time of contact at present allowed on the matured beds, though at times when the sewage is dilute one hour's contact is found to be adequate.

This method of bringing the beds into work has been adopted with

other beds as they came into use, the duration and the number of fillings per week being dependent to some extent on the season and on the dilution of the sewage. It has been found, as might be expected, that the beds mature most rapidly during the summer months. The time of contact may also be decreased and the number of fillings increased when the sewage is dilute.

It is probable that the good effect of a long contact in the initial stages of a bed is due largely to physical causes. The purely absorptive action of the medium, whereby the finely suspended matter and some of the matters in solution are retained by the medium to be subsequently oxidised during the period of rest, doubtless requires a longer time to be effective when the bed is new than when the clinkers are more or less coated with humus. At the same time, no doubt, purely hydrolytic fermentation has a better chance of attaining completion during a long period of contact. When once nitrification begins, another class of change probably sets in. Altogether, it is believed that the sequence of changes that takes place in contact beds is by no means simple,* and data are being accumulated which it is hoped will throw further light upon the mechanism of the purification process which takes place on contact beds and in continuous filters.

In order to prevent as far as possible the suspended matters of the tank effluent from passing into the body of the bed, it has been customary, after the beds have been at work for some months and the clinkers have settled down, to cut radial grips on the surface and to line them with an inch or two of fine screenings. The suspended matter tends to accumulate in these grips, and in time to prevent the ready percolation of the water. When this is the case the grips are scraped, and the scraped-off material either placed on the side of the grip to weather or removed altogether from the bed.

Broadly speaking, after the bed is in full work the scraping of the grips has been necessary about once a fortnight, and a renewal of an inch or so of fine material about once in six weeks.

Recently these operations have become less frequently necessary, a slight raking of the grips being in many cases sufficient. From the experience with the experimental beds A, B, and C, whose surfaces have for some years been gripped, and the labour on which has been almost negligible, it would appear as if the character of the surface of the grip altered as time

* See author's lecture, "The application of chemical analysis to the study of the biological processes of sewage purification." Sherratt and Hughes, Manchester University Press.

went on, becoming more loamy and less liable to be blocked by a greasy or gelatinous deposit. This is confirmed by the experience of Dr. Dunbar in his recent experiments at Hamburg.*

Examination of the material of the half acre beds shows unquestionably that a large proportion of the suspended matter is retained in the grips. It is important only that the rate of flow on to the bed be adjusted and the condition of the grips carefully observed so that breaking down of the sides of the grip shall not occur, admitting the tank effluent directly into the body of the bed. The equable distribution of the effluent is facilitated by the semi-circular inlet cells. In general the beds take about an hour to fill. That this method of working of the beds has been successful in helping to retain their capacity is evident from the results obtained with Bed 1A which has been longest in use.

The curve of capacity is much flatter than in the case of any of the experimental beds, and after upwards of 700 fillings the capacity was 143,000 gallons, or 31·5 per cent. of the empty tank.

Capacities of Beds.—It should be explained that the quantities given in Tables I. and II.† have been obtained by the use of the following sliding scale of capacities based on the measurements which have been made :—

No. of Fillings.	Capacity of bed in Gallons.
0 to 200	180,000
200 to 500	160,000
500 to 750	150,000
750 to 1,000	140,000
1,000 +	130,000

The quantity dealt with by each bed during a week was obtained by multiplying the number of fillings into the estimated capacity at the time. Although in some cases this might tend to give numbers rather in excess of the actual amount dealt with, yet the average result is believed to be approximately correct, as it is confirmed by the computations made in connection with the sewage flow.

In the preceding table will be found a number of measurements of capacity which have been made by means of a specially devised outlet meter. It should be noted that the measurements for beds 1a, 2a, 1, and 8, do not include the contents of the underdrains, as these beds are, as a rule, owing to special features in their construction, only emptied to the level of the

* *Gesundheits-Ingenieur*, No. 4, 1903, p. 58.

† These tables are printed in the Annual Report of the Manchester Rivers Committee for the year ending March 30th, 1904.

Capacity Measurements—Half Acre Beds.

Bed No. 1a.			Bed No. 1.			Bed No. 8.			Bed No. 2a.		
Date.	No. of Fillings.	Capacity in Gallons.	Date.	No. of Fillings.	Capacity in Gallons.	Date.	No. of Fillings.	Capacity in Gallons.	Date.	No. of Fillings.	Capacity in Gallons.
1903.			1903.			1904.			1903.		
April 27th	810	121,160	November 4th..	872	126,300	January 18th...	817	167,340*	April 23rd	543	136,570
May 13th	824	131,940				March 7th	903	133,990			
June 22nd	879	132,320							1904.		
August 21st	970	127,690							January 25th...	988	108,140
October 26th.....	1,070	128,800							February 29th..	1,037	122,030
1894.											
February 1st.....	1,236	115,910									
Bed No. 2.			**Bed No. 3.**			**Bed No. 5.**			**Bed No. 9.**		
1903.			1903.			1903.			1903.		
November 16th...	759	137,610	July 27th	484	188,020	August 13th ...	499	164,000	December 8th ..	597	203,340
			1904.			1904.					
			March 24th ..	912	136,320	March 24th ...	914	127,330			

underdrains; consequently their capacity measurements will tend to be rather below the average of the remainder of the beds, which are completely emptied after each filling. It should be noted that the high measurement recorded for bed No. 8 on January 18th, 1904, was after a prolonged period of rest. The exceptional capacity of bed No. 9 is due to the fact that it is some six inches deeper than the majority of the beds.

Experiments have been made on various methods of measuring the capacity by ascertaining the quantity of tank effluent to fill the bed rather than the amount of filtrate discharged. It has been finally decided that the most satisfactory method is by means of a modified form of a Venturi meter, placed in a specially-constructed chamber at the inlet to the bed.

AUTOMATIC GEAR.

During the past year a third form of automatic gear has been experimented with, in addition to the two mentioned in the report published in July, 1902. In this form of apparatus the only attention necessary on the part of the attendant is the pushing down of a lever at the time of filling the bed; the closing of the inlet, the holding full for a specified time, and the discharge are performed automatically. The apparatus allows of adjustment, according to the varying condition of the surface of the bed, *i.e.*, according to the rate at which the water penetrated the material of the bed.

Prolonged and careful observation of the various forms of automatic and semi-automatic gear which have been experimented with has led to the conclusion that it is quite possible to operate beds, if necessary, from a central station by means of such apparatus.

It has, however, at the same time, been found that one workman, working under instructions from the superintendent, can attend to as many as twenty acres of beds, opening and shutting the necessary sluices, and sampling and booking the time of filling and emptying of each bed. Moreover, for the proper management of large works, constant personal supervision is necessary, and, therefore, it has been considered that the large expenditure entailed by an installation of automatic appliances, both for original cost and subsequent maintenance, is not justified by any possible advantage.

COMPOSITION OF FILTRATE.

The characteristics of the average filtrate obtained from the matured half-acre beds may be summarised as follows :—

(*a*) The oxygen absorbed from permanganate in four hours varies from 1·6 to 2·0 grains per gallon, or 2·3 to 2·9 parts per 100,000.

(*b*) It is seldom putrefactive on incubation.

(*c*) The albuminoid ammonia test averages about ·13 grain per gallon, or ·19 part per 100,000.

(*d*) It always shows signs of nitrification being well advanced.

(*e*) It leaves, as a rule, from 50 to 60 per cent. dissolved oxygen still present after 48 hours incubation at 80° Fahrenheit, with aerated tap water in the proportion of 9 water to 1 of sample.

(*f*) It tends to form a deposit on standing, but seldom amounting to more than 3 grains per gallon.

It must be remembered that at present the tanks supplying the half-acre beds cannot be used to the best advantage, as they have to be practically stopped during the hours when chemical treatment is in force, and consequently worked at an excessive speed at other times. When the works are completed it will be possible to run the tanks more regularly, and, in consequence, a filtrate of greater purity and more constant composition should be obtained. Further, it has been ascertained that the rather high figures for the four hours' oxygen test are chiefly due to the presence in Manchester sewage of large quantities of ammonia recovery liquor and waste effluent from spent oxide washings, the sulphocyanates in which consume permanganate readily. The matter is receiving careful attention, and it is hoped that means may be found of dealing with these effluents before their entry into the sewer.

The results of the incubator test show that in many cases, although a certain proportion of the samples in a given week may be returned as putrefactive, yet the increase in the three minutes' oxygen test, after incubation, is not serious. It is on this quantitative measure of putrescence that the filtrate should be judged, as only a rough classification is possible by physical tests alone.

The question of the formation of a deposit on standing has received a considerable amount of attention during the past year, and experiments are still in progress with a view to the determination of its exact character and the conditions which will prevent its formation or permit of its ready removal. The deposit is greatest in amount in the case of new beds, after the long contacts which are allowed for the maturing of the beds have been in operation for some time. In this case the deposit is undoubtedly in part due to fungoid growth, which diminishes in quantity as nitrification sets in. With matured beds the deposit is greatest from the first flush,

and in this case consists largely of mineral matter, chiefly salts of iron and lime, some phosphate of lime being present. It is intended to adopt some rapid method of secondary treatment, to remove this deposit.

THE STORM BEDS.

The original intention was to put only the weak night sewage on to the storm beds in dry weather, but in order to produce as good an average effluent as possible pending the completion of the works, the effluent from the chemical treatment of a part of the day sewage has been put upon them. This should be borne in mind in judging the average quantities dealt with by these beds, as they were constructed with the view of dealing at a rapid rate with dilute sewage only.

As regards analytical work, separate analysis is made each day of the average tank effluent passing to each area, and of the discharge, individual beds being sampled separately from time to time, as appears desirable.

All these arrangements are subject to modification in time of storm. The procedure depends in such a case on the dilution of the sewage, the number of fillings being increased and the water allowed to pond up to the level of the bellmouth, or even to flow continuously through the bellmouths for limited periods. The average results obtained when the beds were working in this manner are given in Table II.

In time of storm, the number of fillings on the half-acre beds is also increased, and in this connection special attention is directed to Table II., where details are given of the results of dealing with storm water on a number of specified dates.

The composition of the total effluent obtained on these occasions is arrived at by averaging the analytical results for the various effluents leaving the works in proportion to the volume of each.

These results show that it is possible to deal satisfactorily with very large volumes of storm water, the returns for October 28th, November 2nd, November 28th, and February 4th being especially noteworthy.

In some cases—*e.g.*, October 28th, 1903—in order to make the best use of the acreage available, the tank effluent was allowed to pass away unfiltered at its period of greatest dilution, only the stronger effluent being put upon the beds. By this means, although the rate of filtration is not very excessive, the average result obtained is more satisfactory than if the beds had been used during the period of greatest dilution.

The results given in Tables I. and II. show that the purification effected by these beds has been highly satisfactory. Owing, doubtless, to the fine material of which they are composed, and the fact that in dry

weather they are only filled once a day, the nitrification in the matured beds has been exceptionally high. The beds which were started in the summer took less time to mature than those which were started in the winter months, but all are now giving satisfactory results. This large production of nitrates in dry weather enables the beds to be successfully used at a more rapid rate, or even as streaming filters in time of storm, and entirely bears out the intention with which the beds were constructed.

The control of the whole of both areas of storm beds has been in the hands of two men, their shifts overlapping two or more hours in the middle of the day. Since the whole area has been in operation, one or two men have been pretty generally employed in removing the grease, which still tends to collect at the corner of the beds, though to a less extent than formerly; these men also attend to the light harrowing of the beds, the harrow being drawn by a donkey. The frequency of this latter operation depends upon the weather, but it is seldom required more than once a month, even on the oldest beds. The largest bed can be harrowed in one shift, so that it is not a very costly operation.

The scraping operations mentioned in the annual report for 1902–3 were continued during the months of May and June, 1903, the whole of the easterly area receiving attention; the amount of labour, however, varying considerably on different beds, the extra labour in many cases being due to relevelling the surface. The cost varied from about 30s. to £12 per bed, all of which is included in the filtration costs.

It may be of interest to note that a sample of the scraped-off material from a specially bad part of the surface was found, on drying and extracting with ether, to yield ·37 per cent. of greasy extract. Dr. Carl Schreiber, in his investigation of the grease on the Berlin land filters, concludes that ·10 per cent. is sufficient to render sand impervious to water.

The scraped-off material was burnt in heaps with the addition of a little coal. After being once started, the heap gradually burnt through with practically no further attention, owing chiefly to the particles of coke and coal intermixed with the original clinker as well as to the grease and other organic matter present; a hard red clinker finally resulted, which although it contained too much dust to be profitably screened, afforded a fair material for making paths.

In determining the necessity of harrowing or scraping the surface of these beds, it should be mentioned that operations are not found to be necessary immediately the surface of the beds shows signs of becoming less pervious. So long as the requisite quantity of water can be passed through the bed in a given time, analysis of the filtrate shows that the

purification is not impaired, but rather increased, by a certain amount of surface resistance.

If, however, the upper part of the bed becomes really sodden, then the purification rapidly falls off, and under these circumstances it is necessary to rest the bed and to loosen the surface.

Examination of the material of the oldest beds a few inches below the surface has up to the present shown the clinkers to be quite sharp and clean. The storm beds, in fact, in their mode of action, and in the character of management required, bear a close analogy to water-works filters.

ESTIMATION OF CAPACITY.

The capacity of the beds has been estimated on the basis of the results obtained with a small experimental filter of cinder screenings mentioned in recent annual reports on the works.

In time of storm the water is allowed to pond up on the surface; the quantity has then been calculated from the depth to which the ponding has reached, which is about six inches in the average.

At times when the bellmouths are in operation and the water is allowed to stream continuously through the beds, it has been estimated that the water has passed through the bed at the rate of 500 gallons per square yard per day.

From observations made of the amount of water passing the gauges in the sewers, at times corresponding to those during which the beds were filled (*i.e.*, allowance being made for the time taken by the flow in passing from the gauges to the works), it would appear that the quantities given in Table I. are rather less than the actual quantities dealt with.

COST OF OPERATIONS.

The total volume of sewage filtered by the various beds during the year ending March 30th, 1904, amounted to 5,654,872,456 gallons, or 43 per cent. of the total quantity of sewage received at the works.

The total cost for labour and incidental expenses, including the whole of the expenditure in connection with the experimental beds, amounted to £1,050 10s. or 3s. 8·6d. per million gallons actually filtered. This figure, obtained on what may be fairly considered an average year's working, is considerably lower than the provisional estimate of 5s. 6d. made in the annual report for 1903. It must, of course, be understood that this item includes all labour involved in opening and shutting sluices and in cleaning the surface of the beds; it does not include any sum for possible

‡TABLE III.—*Comparative*

	MANCHESTER.	
Population	574,800	
Character of Sewage (purely domestic or manufacturing).	Manufacturing.	
Dry weather flow per head of population	40	
Average flow per head of population	60	
Tank Treatment... Chemical	½-*Acre Beds.*	*Storm Beds.*
Sedimentation	.....	Chemical.
Septic	Open Septic.	Sedimentation.
Filtration System ... Intermittent	Intermittent.	Intermittent.
Continuous	.....	Streaming.
Size of filtering medium	3/16 in. and upwards.	Ungraded clinker, free from dust. Large clinker round drains.
Percentage Purification on Tank Effluent—		
4 Hours' Oxygen Test	68 per cent.	75 per cent.
Albuminoid	59 per cent.	72 per cent.
Percentage of Free Ammonia in Tank Effluent appearing as Nitrite and Nitrate in filtrate	17 per cent.	36 per cent.
Average quantity dealt with per acre yard per day during 1 year, including all rests	431,000	377,000
Construction cost per acre yard	£2,376	£1,765
Working cost of beds per million gallons filtered (apart from renewal of material and miscellaneous expenses of works management), average per annum	3s. 8d.	
Renewal cost per acre yard per annum, average	£50 (estimated from Burnley results).	£40
Renewal cost per million gallons filtered	6s. 6d.	5s. 9d.
Cost of sludge disposal per million gallons of sewage	10s. 3d.	.....
Total cost of treatment per million gallons—		
Dry weather flow	£1 13s. 5d.	.....
Total flow	£1 2s. 3·9d.	.....
Remarks	The total cost of treatment does not include renewal costs, which have not yet been incurred. On the other hand, the cost of sludge disposal will probably be reduced in the future.	

‡ These tables are printed in the Annual Report of the Manchester

Data re Filtration of Tank Effluent.

ACCRINGTON.	BURNLEY.	OLDHAM.	BIRMINGHAM.
50,000	98,400	154,000	750,000
Domestic and Trade	Principally domestic.	Mainly domestic (great proportion of slop water-closets).	Domestic and manufacturing.
24¼	25	17¾	30
35¾	.....	*1902* 28·6 *1903* 40·2	40 (approx.)
.....	.....	Sedimentation.	Sedimentation.
Two series of three open Septic Tanks.	Open Septic Tanks (with very large detritus tanks).	About ⅛ of flow through experimental closed tank.	Septic.
.....	Intermittent.	Intermittent.	Mainly land treatment.
Continuous.	.....	Occasionally streamed in time of storm.	Continuous.
2 to 3 in.	Primary Beds ¾ in. and upwards. Secondary Beds ⅛ in. to ¾ in. (The above are both washed and screened.)	Ungraded clinker, &c., free from dust. Large clinker round drains.	2½ in., 1½ in., 1 in., and ½ in.
		Jan.–May.	
77 per cent.	87 per cent.	*1903* 73·7 *1904* 75·4	
75 per cent.	87 per cent.	57·9 56·7	
		1903 *1904*	
60 per cent.	29 per cent.	12·7 12·2	
		1903 *1904*	
645,300	169,400 by double contact.	286,000 363,426 exclusive of storm-water.	
£3,630	£1,300	£800 (approx.)	£3,000
		1903 *1904*	
1s. 11d.	7s. 6d.*	6s. 3·3d. 4s. 8·3d.	£20 per ¼ acre bed per annum.
Nil.	.....	£41 7s.	Nil.
Nil.	16s.	7s. 11d.	Nil.
2s. 8d.*	5s. 8d.	14s. 1d.	3d. per ton.
		1902 *1903*	
£3 7s. 0d.† £2 4s. 8d.	£3 7s. 6·7d.†	£1 14s. 8d. £1 4s. 8d.†	

* The sludge is lagooned and sold; the cost given is the net cost.

† The total cost is largely due to pumping, which it is intended shortly to dispense with.

* Cost of working beds, sampling, weeding, and cleaning and levelling distributing troughs.

† Total expenditure £2,866 8s. Receipts from sludge manure and crops £400 8s. Net cost £2,466.

† Abnormal rainfall of 1903 reduces cost per million gallons.

renewing or washing in the future, towards which an item is set aside every year in the estimates.

In judging of the success or otherwise of a sewage purification works, it is necessary not only to consider the purity of the final effluent, but also the cost involved in its production. This would appear to be a truism, but it is, I venture to think, sometimes forgotten. I have on another occasion defined the sewage problem as consisting in purifying sewage to well within the limits of safety for any given set of conditions, at the lowest possible cost. There is no reason, to take an extreme case, to strive to obtain the same state of purity in an effluent flowing into a tidal river, as is required for one which enters a drinking-water stream. Further, in deciding between the relative merits of two processes, it is sometimes found that a small superiority in the effluent obtained in the one case is accompanied by an altogether disproportionate cost. *A priori* arguments are of very little use in forming judgment in special cases. What is required is a large number of sound comparative data of costs and results under several typical conditions. These at present are hard to come by, as is evidenced by the numerous *lacunæ* in the otherwise extremely interesting tables published by the President of this Section. I would strongly urge all those who have charge of sewage works to keep their results and their costs in such a form that they may be of benefit to others. Such data would be of the greatest value, not only in deciding upon the methods to be followed in the case of a new scheme, but in enabling a judgment to be formed as to whether the works are being economically conducted or not. At present it is to be feared that we are all working somewhat in the dark.

Through the kindness of some of my friends I am able to give a preliminary table of data which, though not complete in all respects, will serve as an illustration of my argument, and as a basis for what I hope may be a useful discussion. For these data I have to thank Mr. Newton, of Accrington; Messrs. Pickles and Ross, of Burnley; Mr. Watson, of Birmingham; and Mr. Valentine, of Oldham.

The following are some of the conclusions which appear to me to be justified by the table:—

1. That it is not possible to say on merely general grounds that one process is to be preferred to another, equally good results being obtained by a number of methods if carried far enough.

2. That percolating filters are more expensive than contact beds in first cost.

3. That whether they justify this extra first cost depends on local conditions.

4. That where pumping would be necessary in order to operate sprinkling filters, as at Burnley, Manchester, and Oldham, then contact beds are cheaper.

5. That where a sufficient area of contact beds can be obtained at a low cost of construction as at Oldham, they are cheaper under all circumstances.

6. That, for purposes of comparison, costs should be calculated on the dry weather flow.

7. That other things being equal a small flow per head conduces to economical treatment.

I have just received, through the courtesy of Mr. Dibdin and the Clerk to the Urban District Council of Alton, Hants, some interesting figures, which, although hardly comparable with those for the large towns given in Table III., have an important bearing on the discussion.

At Alton, where the daily flow of 160,000 gallons is made up of two-thirds domestic sewage and one-third brewery refuse (making, with 40,000 gallons subsoil water, a total of 50 gallons per head) the sewage is pumped direct into coarse bacteria beds, flows thence on to fine beds, and finally over five acres of land containing porous gravel, from which no effluent issues. Here the cost of sludge disposal is nil, and the main cost is for renewal of material. This works out to a total cost, excluding pumping, etc., of £1 5s. 10d. per million gallons, plus a proportion of the costs for supervision. Of this, £1 is for material only, which appears to me to be more than is commonly necessary. Bearing in mind that the sludge difficulty, often a very troublesome one in small works, is here entirely removed, these figures would indicate that there is much to be said for the direct treatment of sewage on coarse beds in certain cases. Mr. Dibdin is of opinion that his novel method of constructing primary beds of layers of slate will be of special value in this direction.

Doubtless further points for discussion will suggest themselves to others. My object is not to uphold the virtues of any one method of treatment, but simply to urge the importance of obtaining trustworthy comparative data.

Further details of the working of the beds at Manchester, and the result of continued experimental work in various directions, will be found in the annual reports of the Rivers Department of the Manchester Corporation.

The obtaining of such data, I need not say, requires unremitting observation and care. Any value which the statistics that have been accumulated in Manchester may possess, is due to the willing co-operation of many hands, and in particular I feel that I ought to mention my first assistant, Mr. Edward Ardern, whose accurate work and thoughtful criticism have been invaluable.

[*This Discussion applies also to the Paper by* Mr. William Shanks.]

Mr. Watson (Birmingham) said that Birmingham had not given all the figures required to complete Dr. Fowler's Table III. Their works were not yet complete, and he was therefore unable to give all the information asked for; indeed he felt that, however desirable it was to make definite comparisons (and he appreciated Dr. Fowler's attempt to do so) it was a most difficult undertaking. The septic effluent as it reached thin percolating filters contained an unusually large amount of solids (15 parts per 100,000), and it was necessary to pass it through silt tanks built on the Dortmund principle before applying it to bacteria beds, with the result that the sewage distributed over the percolating beds contained little more than 5 parts per 100,000. The filtrate from the percolating beds was good enough to enter a stream without further treatment; it was non-putrescible, and contained about 4 parts per 100,000 of nitrates. Still, he proposed to pass it over a secondary bed, not so much with the object of obtaining a higher degree of purity as to force the pace, so to speak, by passing a larger quantity of sewage through the beds in a given time. Then the fact that their population was about 850,000, while the dry weather flow was only 25,000,000 gallons per day, further accentuated the difficulty of comparing the treatment of Manchester sewage and Birmingham sewage. He could not therefore agree with the suggestion of Dr. Fowler, that for the purpose of comparison cost should be calculated on each million gallons of dry weather flow. It was the filth which had to be eliminated from the sewage that constituted the amount of work done by a bacteria bed. Measured by the oxygen-absorbed test, the Birmingham sewage showed a daily average for the past year of upwards of 20 parts per 100,000. In order to measure the amount of work done on his various experimental bacteria beds, his chemist (Mr. O'Shaugnessy) had made a valuable suggestion, which was worthy of being placed before the Section. In the terms of an equation it was as follows:

$$\frac{\text{Impurities eliminated measured by oxygen-absorbed test in parts per 100,000} \times \text{quantity treated on unit area in lbs.}}{100{,}000 \times \text{depth of bed}}$$

= work done by bed per unit foot (measured by oxygen required to eliminate

the impurities). Suppose, for example, that the sewage put on a percolating bed was 11·480 and the filtrate ·772 (oxygen absorbed), and that that bed was seven feet deep and treating 810,000 gallons per acre per day, the calculation would be stated thus:

$$\frac{10{\cdot}708 \times 810{,}000 \text{ galls. per day per acre} \times 10 \text{ lbs.}}{100{,}000 \times 7 \text{ feet.}} = 118{\cdot}66 \text{ lbs. oxygen.}$$

That is, impurities have been eliminated that would require the use of 118·66 lbs. of oxygen per acre foot of bed. Although this equation may not be absolutely comprehensive it was the best he had seen, and where comparisons had to be made was worthy of consideration.

Mr. Ross (Burnley) said that as regarded the filling up they had movable screens, and the screening could be done at a cost of one shilling and a fraction of a penny per cubic yard. He could take the material from the bed and screen it. The whole of the material was washed by tank effluent, and the fine portions taken to the second-contact bed, and the heavier material went into the first contact beds. It was only by thoroughly washing that they could hope to clean a bed properly. In many instances a great deal of concrete was put down and money laid out which in his opinion was unnecessary. He had no concrete, but a clay bottom, and it was absolutely clean. In fact, he was so much struck with one they had been using for five years that when they were re-screening it he had a photograph taken, and the bottom was as perfect as they could wish to see. As regarded percolating filters, if there was any iron present they always got an iron deposit, and they often got a deposit on the surface if there was a fair amount of trade effluent present, which would absolutely block any fine material put on the top. Their fine contact beds required in three years fifty-eight days' rest, as against only ten days' rest required by carefully-washed material.

Mr. D. Archibald (London) pointed out that Mr. Shanks had not stated what the average flow treated at Barrhead was, and it was an important point to know how much overflow was allowed. In cases where the septic tank system was employed, or, in fact, any system, it was a very valuable point to know how much could be treated on a certain area, and how much was allowed to go into the stream untreated. When he visited Barrhead some time ago he noticed that there was an overflow. There was one before it went into the tank and one before it went on the bed. As to Dr. Fowler's paper, there was one point he would like to ask about. Dr. Fowler referred to chemical treatment, and it was obvious that chemical treatment might vary according to the nature and quality of the materials used. It would be well to know what exact chemical treatment was referred to in this special case, as it was possible there might be a means of avoiding this secondary deposit by the use of suitable chemicals, and perhaps the

result might be considerably better than appeared from the diagrams. Dr. Fowler had drawn attention to the total cost of systems, and he felt it would be of great use if everyone were to adopt the method of detailing the cost. Where they had systems where there were large capital costs, like sewage farms, and where the cost of maintenance was small, it was idle to compare the cost of maintenance in that case against the cost of works where the works were small and the cost of treatment comparatively large. The better plan would be to take the interest on capital, add up the cost of maintenance, and totalise the whole thing. Otherwise, it was attempting to compare things which were incomparable. So far as he could make out, the cost of the renewal of the filters at Manchester was apparently the same as the cost of chemicals under the old system. He thought one cubic yard of contact bed might be said to be necessary for one person where the system was purely bacterial, and in that case they could calculate the cost of renewal.

Dr. Barwise (Derbyshire) said that he would not have intervened in the discussion but for the second conclusion which Dr. Fowler had come to: that percolating filters are more expensive than contact beds in first cost. They might remember that The Sanitary Institute, at its Birmingham Sessional Meeting last summer, discussed the question of sewage purification, and there was no one present at that meeting, except Mr. Martin, who was not agreed that contact beds were things which were dead, and the meeting did not seem to be sorry. He congratulated Dr. Fowler on his efforts to resuscitate the contact bed, and it appeared to be in a very lively condition that day. One of Dr. Fowler's reasons for bringing it to life again was that he said it was cheaper than percolating filters, but why did he say that? Dr. Fowler put certain figures before them of places which were absolutely incomparable. He had compared patented processes with unpatented processes. Everybody should know by this time that it was quite possible to purify sewage, either by percolating filters or contact beds, without infringing any patents whatever. The figures he gave were on a standard of an acre per yard. The lowest figure Dr. Fowler gave for percolating filters was about £3,000 per acre yard. He had in his district filters which cost less than £500 per acre yard, although he did not suggest that that figure could be published as an average figure. He knew those filters had been constructed under special circumstances. They were filters which were simply ashes thrown about the ground without any expensive retaining walls, and without any stonework or brickwork to hold the filter up. Revolving arms had been constructed at intervals to distribute the sewage at little expense, and these works worked out at £500 per acre yard. He was not claiming that that could be done everywhere. The point was whether contact beds or percolating filters were the cheaper, and that could be settled by simple general considerations. The most expensive part was the material. Which was going to cost most—the throwing of that material on the ground without any retaining walls, or the constructing a watertight com-

partment to put that material in? because a contact bed must be made watertight, whereas a percolating filter need not be watertight. He did not agree with the statement that what was required was a large number of separate comparative data of costs and results under several typical conditions. The only way to get a comparative result of the two systems was to have them both constructed at the same place, of the same material. At Chesterfield the Corporation did this, and they had given up contact beds and gone in for percolating filters. Mr. Mansergh went before a Parliamentary Committee with a scheme of single-contact and had to change the scheme to double contact, but when he came to construct the works he found he had not enough money to do it, and had to put down revolving arms and percolating filters. He also disagreed with Dr. Fowler's conclusions that for purposes of comparison costs should be calculated on the dry-weather flow. In his district he had a dry-weather flow of 120 gallons per head per day, and on that data they would find the cost would be much less, and it would be unfair to Manchester to compare it with, say, Buxton. He joined with Mr. Ross in his protest against the unnecessary expenditure which most members of the engineering profession were putting authorities to in making their works look beautiful. He did not think there was any necessity for anything beyond the foundations for the revolving arms. With regard to the suspended matter, they could have a little preliminary filter with fine stuff on the top, and bring the sewage back to the same level. It was all very well to say that they would plug up, but he had had filters at work for five years and they had not blocked up.

MR. A. J. MARTIN (London) said Mr. Shanks' paper was especially interesting to him inasmuch as he was responsible for the design of the Barrhead works, though not for their execution. The results which Mr. Shanks had described were the more gratifying because, when the works were laid down, there was very little experience available for guidance in their design. The subject of suspended solids had been mentioned by several speakers, and it had been assumed that they could not get a septic tank effluent with less than 15 parts per hundred-thousand, but that depended largely on the design of the tanks and the way in which they were worked. Dr. Barwise had mentioned one way of freeing the effluent from suspended matter, and he (Mr. Martin) employed another method which had very satisfactory results. An indictment had been brought against the profession to which he belonged of piling up the cost of works by the adoption of unnecessarily expensive modes of construction. They must not blame the engineers altogether for this, as it was a matter with regard to which they were in the hands of the Local Government Board. The engineer to a local authority, who could get an effluent good enough for their requirements at a certain cost, was often compelled to set aside his own predilections and lay down works which meant a greater expenditure of money. His experience was that

local authorities jumped at schemes which promised a low initial expenditure and would not have regard to cost of workings. He thought Dr. Fowler had put that point forward in an eminently practical way. Local authorities would rather save £1,000 in the first instance, although by doing so they committed themselves to an extra expenditure of £100 per annum hereafter. As to the question of automatic versus non-automatic working he did not think Dr. Fowler's experience could be taken as a guide generally, and for this reason: In Dr. Fowler's case they had works under splendid management, and the same applied in the case of Birmingham and other large works. In those places they had men qualified in every way to exert a constant and efficient supervision of the working. But as an engineer one had to deal more frequently with authorities which were not in a position to incur the expense, or would not do so, of putting men in charge of their works of the attainments of Dr. Fowler or Mr. Watson, and in such cases it might be very desirable to adopt some mode of automatic working. The cases of Manchester and Birmingham were moreover unique in that the men who designed the works retained control of their operation. The unfortunate engineer, however, was in the position of having to lay down works and hand them over to the local authority. The local authority entrusted them to a man who might or might not take an intelligent and conscientious view of his duties; and in too many cases the works were neglected and not carried out in harmony with the intention of the designer. He would like to put on record a strong expression of opinion to the effect that it was the duty and the interest of local authorities to insist on the engineer who designed the works exercising some sort of supervision of their management, possibly in the way of paying a surprise visit once or twice a year.

Mr. C. H. Cooper (Wimbledon) said that in two filters he had charge of the surface was covered with fine material. In all the Wimbledon filters the surface is to a certain extent covered with fine material, but if this is done much it interferes with the aeration of the filter and with its working. The old reports of the Massachusetts experiments gave some very good results as regarded the use of fine material, showing that the amount of sewage that could be treated on fine material beds was less than could be treated on coarse beds. He was in the happy position of never having had to place his filters in concrete, all his filters having been constructed by excavation in the London clay. In cases he knew of, the Local Government Board insisted on concrete tanks, and it would be a good thing if some representations could be made to the Board to abandon what was absolutely useless in many cases, and which almost doubled the cost of contact beds. As regarded comparative cost, he was sorry Dr. Fowler had not compared the total costs, including repayment of loans. In Wimbledon, including the repayment of loans on the cost of purchasing 65 acres of land and the total cost of works, the cost of sewage treatment was less than 3d. in the £ on the rates. Mr. Shanks had given them the cost at

Barrhead at 10d. in the £, but he could not understand how, after the works had been paid for, the cost would be only ½d. in the £ per annum. He felt that this conclusion at the end of Dr. Fowler's paper was the only weak point in it, and it was certainly a pity he had stated what he did as regards the dry weather flow. As to the chemical treatment, they had no definite idea of what it meant, and would like to know the amount of chemicals added, and especially the amount of lime.

DR. EUSTACE HILL (Durham) did not agree that it was the general opinion that the double contact system was dead. Durham was a very populous county, and his experience was that the contact system was very much alive there, and was very successful in disposing of the sewage of small towns and villages. They had a large number of contact beds in the county, and lately they had also been experimenting with percolating filters, and their experience had been that while the cost was somewhat larger, yet the double contact results were better than those of the percolating filters. As to the suspended matter coming from percolating filters he thought it would be admitted that from double contact beds working properly they did not get any appreciable suspended matter in the final effluent. He was not against percolating filters, and believed that when properly constructed and managed, they were good and were in many instances preferable to double contact beds. A good way to get rid of the suspended matter passing from percolating filters, was to let the effluent run into a small pond where settling could take place. Such an arrangement was much simpler and more satisfactory than that advocated by Dr. Barwise.

MR. SHANKS (Barrhead) said that with reference to the total flow of sewage from the Barrhead works, they had 400,000 gallons. They did not take the surface water and only a proportion of the roof water. When the wet weather came on, a certain quantity of surface water forced its way into the sewers, and that produced an overflow during wet weather. The present sewage rate at Barrhead was 10d. in the £, which included the sewers as well as the purification works. The greater proportion of this went for the payment of interest and loan, and he calculated that when this was paid off the sewage disposal would only cost ½d. in the £.

DR. G. FOWLER (Manchester) said from Dr. Barwise's remarks he feared he had not made himself clear. He did not wish to pose as a partisan of any one system at all. It was a matter of indifference to him how sewage was purified, so long as it was purified, and at the least possible cost. There were too many of these sweeping statements on one thing and another. Let them quietly consider the special circumstances for each case. That was really the burden of his paper, and he did not wish it to

be understood that he was advocating any one thing in particular. He was much interested to hear of those cheaply-constructed continuous filters, for it was rather new to him that such filters could be constructed. He took the cost of his works as a basis of comparison, but if continuous filters could be done at that price put them up by all means, only let them consider the whole thing from one end to the other, as far as they could, before coming to a conclusion. He admitted that differences of opinion could reasonably be felt about many of his conclusions. From the facts before him, certain things appeared to him to be justified, and he put them down rather with the view of getting other people's opinion. As to the question of cost of interest and sinking fund, it was very important, but it was extremely difficult to get, because the loans were on different terms in different places.

SEWAGE DISPOSAL ON CHALK SOILS.

By Lt.-Col. A. M. DAVIES, R.A.M.C., D.P.H.,
(Fellow);

And W. C. TYNDALE, M.Inst.C.E.
Sanitary Engineer to the War Department.
(Fellow.)

As in the course of our duties we have had occasion to be concerned with the effects of the disposal of sewage on chalk soils, and as no detailed investigations on this subject appear to have been made, or at any rate published, it seemed desirable, if possible, to make such tests as would throw definite light on the matter, and by careful bacteriological examination of the soil and subsoil water, under and near to a sewaged area, to ascertain the efficacy of chalk as a purifier, and whether the underground water derived from such an area is affected, and, if so, in what way.

At the site of some barracks on Salisbury Plain, near Amesbury, the conditions appeared to be favourable for such an investigation, and in the summer of 1902 we were authorised to carry out the needful experiments.

Several instances have been recorded of the occurrence of pollution of wells in the chalk, owing to the discharge of sewage in their neighbourhood, which, travelling along fissures in this formation, had found its way directly into the subsoil water; but the conditions attending on such cases differ widely from those now under consideration, where sewage is treated *upon the surface* by irrigation over a layer of surface soil, and where the chalk itself is compact and free from fissures. As to the chemical and biological action which takes place in the chalk on sewage matter that is applied to it, and the effects of such application on the derived ground water, different opinions have been held. Some have thought that no nitrification or purification would take place, and that the sewage would percolate through fissures to the underground water, with practically no change or improvement in its condition. Others have maintained that nitrification does occur, at any rate where there is a layer of top soil; that no fissures exist in the upper layers of the chalk, which

is so disintegrated as to form an efficient filter; and that therefore, instead of rapidly percolating down to the underground water, the liquid would be absorbed by the surface chalk until this was super-saturated, the subsequent passage downward taking place only by a gradual process of saturation.

The conditions prevailing at the site selected are as follows: The adjacent barracks, occupying about 100 acres, are situated on a plateau having a gentle slope northward to the Nine Mile River, from which they are about 300 yards distant. The intervening ground between the barracks and the river falls more rapidly, the difference in levels being about 75 feet. This land is all composed of chalk subsoil, with a thickness of about one foot of overlying earth.

A main drain conducts the sewage from the barracks to the upper border of a long field running parallel with the river, and having a slope towards the river of about 1 in 90. Along the upper side of this field runs a carrier of 9-in. channelling, with outlets at every 30 feet, through which the sewage is let out in rotation over the sloping surface: the area irrigated has been about 4 acres: the total area dominated by the carrier is about 18 acres; the distance of the field from barracks is about 175 yards.

The average daily volume of sewage applied has been about 35,000 gallons, consisting of slop-water, urine, and stable drainage from 1,377 persons and 523 horses, with a small amount of water-closet sewage. At first it was led through a septic tank; but it was found that septic action was retarded and offensive smells were produced; probably this was owing to its peculiar constitution, stable drainage being present in large proportion. The sewage, therefore, was subsequently brought to the land in a crude state and applied to it directly; this went on for about two years.

As to the physical condition of the chalk in this district, so far as our observations go it appears to be, in its upper layers, soft, compact, homogeneous, and free from fissures. This appears to be the case over Salisbury Plain generally; as Mr. Clement Reid, F.R.S., of the Geological Survey (Survey Memoirs, The Geology of the Country around Salisbury, 1903, p. 49) states that: "The Upper Chalk is 700 or 800 feet thick, so that hills and valleys can be carved out of it without any other rock being exposed. Most of the wide expanse of Salisbury Plain is Upper Chalk. In its character and composition this great mass of rock is singularly uniform: nearly all of it is soft white chalk with flint nodules scattered more or less in lines."

As to the underground water in this situation, it appears from a comparison of the water-levels in the wells to the N.E. and S.E. of the

barracks, with the level of the water in the bed of the Nine Mile River, that the local direction of its flow (hydraulic gradient) is from below the barrack plateau and the sewage irrigated plateau towards the stream. This stream is a bourne rather than a true river, and its flow depends entirely on the level of the underground water in the chalk, which wells up in its bed at varying distances: of late years it has been practically dry, water appearing only near its confluence with the Avon at Bulford and just below the site of the barracks. In that portion of its bed that is opposite the barracks, the underground water was met with on digging down a few inches.

Our experiments were directed to ascertain how far the polluting effect of sewage applied to a chalk soil might be expected to extend, both in a downward direction, vertically into the chalk, and in a horizontal direction, along, or immediately beneath, the surface layers of the soil. Samples of water were examined from the bed of the Nine Mile River, into which the surface drainage, if any, from the sewage irrigated area would find its way, and towards which the underground flow appears to trend. Samples of soil were examined, taken at about 18 inches below the surface (this being the level of the junction of surface soil and the chalk), and at varying distances below the main sewage carrier. Subsequently, a heading was driven for a distance of 60 feet, beneath the irrigated tract; the surface of the ground being on a slope, and the heading being horizontal, the intervening thickness of soil increased from the mouth of the heading inwards. Samples of subsoil were taken at specified depths beneath the surface.

The following is a summary of the bacteriological investigations, the details of which are given in the appendix:—

The observations were commenced on 22nd July, 1902, when two samples of water (A. Nos. 1 and 2) and four samples of soil (B. Nos. I. to IV.) were examined.

The samples of water were obtained from holes dug in the (dry) bed of the Nine Mile River, opposite the sewage-irrigated area; if contamination of the stream, or of the underground water in the bed of the stream, were to occur—either from access of washings off the surface of the irrigated area, or from soakage finding its way down beneath the surface—such contamination would probably be detected in this situation; other sources of contamination, as from cattle, or from drainage from the upper part of the valley, cannot, however, be eliminated. Both samples of water contained *B. coli;* in neither was *B. enteritidis sporogenes* detected. The soil samples were taken from the hillside, below the sewage irrigated area;

in a shallow hole dug ten yards below the main sewage-carrier *Bacillus coli* was found, but not *B. enteritidis sporogenes;* in a similar hole, 35 yards lower down, both *B. coli* and *B. enteritidis sporogenes* were found; but in a hole 70 yards below the carrier (and just beyond the area reached by the sewage), neither *B. coli* nor *B. enteritidis sporogenes* could be detected. In a hole about 20 yards below the main carrier in another part of the irrigated area, *B. enteritidis sporogenes* was detected, but not *B. coli.*

On 7th August, 1902 (care having been taken that the application of sewage should be regular during the preceding seven days) soil samples (B. Nos. V. and VI.) were taken from two holes on the hillside, respectively 10 feet and 50 feet below the lowest point to which the sewage had flowed; in neither sample were *B. coli*, *B. enteritidis sporogenes*, or *streptococci* to be found.

On the same day two samples of water were taken from the Nine Mile River, just above the new bridge (A. Nos. 3 and 4); neither *B. enteritidis sporogenes* nor *streptococci* were present, but in one sample *B. coli* was found, and in the other an organism somewhat resembling *B. coli.* Water was also taken from holes dug in the (dry) bed of the stream at a spot opposite the irrigated area (No. 5), and at a spot three furlongs higher up the valley (No. 6). Neither *B. enteritidis sporogenes* nor *streptococci* were found; but in the former sample *B. coli* was present in abundance, and in the latter, an organism somewhat resembling *B. coli.*

From the foregoing experiments it appeared as if the sewage organisms applied to the surface of the soil travelled to only a very slight extent horizontally along the surface layers. As before mentioned, in order to find whether they could be traced to any considerable distance downwards, through the chalk, a tunnel was driven, 60 feet in length, under the sewage-irrigated area; the depth beneath the surface of the ground being 9 feet at the head of the tunnel, 6 feet in the middle, and 4 feet just within the entrance. The head of the tunnel was distant 91 feet, in a horizontal direction, from the main sewage carrier; and the mouth of the tunnel 60 feet further away. On 14th October, 1902, samples of chalk subsoil (C. Nos. i., ii., iii.) were taken in each of the situations and examined. The overlying ground had been irrigated with sewage for the preceding two years. No trace was found either of *B. coli* or *B. enteritidis sporogenes*, nor were any gas-forming bacteria found, even in two decigrammes of soil.

It was then arranged that the whole of the foul water should be applied to the particular plot of ground overlying the tunnel: this was accordingly deluged with sewage for 14 days; and on 25th of November,

1902, three more subsoil samples (C. Nos. iv., v., vi.) were examined, taken from the same points in the tunnel as before. At the head of the tunnel (90 feet from the carrier) and 9 feet beneath the surface, coliform organisms were found to be present in one milligramme of soil: gas-forming organisms were found in one centigramme, but not in one milligramme: *B. enteritidis sporogenes* was not found in one centigramme. At 6 feet beneath the surface (but 30 feet further from the sewage carrier) coliform organisms were detected in one centigramme, also gas-forming bacteria; neither were found in one milligramme. *B. enteritidis sporogenes* was not detected in one centigramme. At 4 feet beneath the surface (but 30 feet still further away from the sewage carrier) neither *B. coli* nor *B. e. sporogenes* nor gas-forming bacteria were found, even in one decigramme (except a small number of the last named).

During December and January the sewage water was applied over the whole area in regular rotation, thereby reverting to the usual routine for distribution, and on 3rd February, 1903, further subsoil samples (C. Nos. vii., viii., ix.) were taken from the tunnel at the same points as before. Coliform organisms were found at the head of the tunnel at a depth of 9 feet (in one centigramme), but no *B. enteritidis sporogenes*, and no gas-forming bacteria. At 6 feet depth and 30 feet further distant, a coliform growth was obtained from one milligramme, but no *B. e. sporogenes*, nor gas-forming bacteria (in one centigramme). At 4 feet depth and 30 feet still further distant no coliform growth, no *B. enteritidis sporogenes*, and no gas-forming bacteria were found in one centigramme.

No *streptococci* were detected in any samples.

The subsoil samples were to all appearance clean and sweet, and free from any smell of sewage, in every case. In Nos. i., ii., iii., and vii. the chalk appeared to be dry; in Nos. iv., v., and vi. (when the ground had been deluged with sewage) it was very moist; in Nos. viii. and ix. it was rather moist. The only sample that showed any appreciable admixture of the surface soil was No. v. (taken at a depth of 6 feet, when the surface was deluged with sewage water).

During 1903 the application of foul water to the irrigation area was continued regularly. At the beginning of October, 60 water-closets were brought into use, and the sewage was led through a septic tank (instead of being distributed, as before, over the ground untreated). Subsoil samples were taken from the same points as before (C, Nos. x., xi., xii.), on the 8th December, 1903. They all appeared to be clean and sweet: no coliform organisms, no *B. enteritidis sporogenes*, no gas-forming bacteria, and no *streptococci* were found in any sample, even in one decigramme.

In these experiments the presence of *B. coli*, *B. enteritidis sporogenes*, *streptococci*, and gas-forming bacteria was sought for, as presumably furnishing evidence of sewage-contamination. *B. coli* is so widely distributed in nature that it is not in itself evidence, nor perhaps even indication, of access of human fæcal matters. As the dry bed of the stream and the adjoining grass-land is a favourite resort for sheep and cattle, its presence in the samples of water in, and near to, the bed of the stream (Nos. 1, 2, 5), as well as the occurrence of a closely-related organism in three other samples (Nos. 3, 4, 6), is probably due to sheep or cattle droppings. In the soil samples (Nos. I., II.) taken from near the sewage carrier, the *B. coli* found was probably derived from the sewage, though other contamination could not be definitely excluded. In the samples of subsoil, however (Nos. iv., v., vii., and possibly viii.), in which *B. coli* or a closely-related organism was found, it can hardly be doubted that these organisms were derived from the sewage which had been applied, in excessive quantities, to the overlying soil during the fortnight immediately preceding.

The presence of *B. e. sporogenes* in the soil samples (Nos. II., IV.) taken from near the sewage carrier, was probably due to access of sewage. This organism was not detected in any sample of subsoil. It seems to have died out quickly. *Streptococci* were not detected in any sample. Gas-forming bacteria were numerous in two samples of water (Nos. 3 and 5), but absent, or relatively few, in all the other samples.

The only bacteriological indication of sewage access to the subsoil was furnished by the presence of coliform organisms in samples Nos. iv., v., vii., and possibly viii. Inasmuch as no such organisms had been found when the subsoil in these situations had been first examined, and as sewage had been deluged upon the overlying soil for the preceding 14 days, it can hardly be doubted that, *in this particular instance*, the coliform organisms were derived from the sewage, and consequently afford trustworthy evidence that the sewage, or its contained organisms, had penetrated to the depths stated.

The conclusions to be derived from these experiments are as follows:—

1. That, in the case of chalk, there is practically no lateral movement of fluid falling on or spread over the surface, but that the moisture passes vertically downward.

2. That, so far as our observations extend, the soakage consists of saturation only, and that in the upper portion of the chalk the liquid forms no defined lines of percolation, resulting in trickles even where the surface is deluged.

3. That, when the surface is deluged, traces of sewage, as evidenced by bacteria, may penetrate to a considerable depth, but that when sewage is applied in an ordinary and reasonable way over the surface, no such contamination of the subsoil takes place.

The details of the analysis of the samples of water and soil are given in the appendix.

Appendix.

Summary of the Bacteriological Examinations.

Method of taking the Soil Samples.—The ground at the selected spot having been excavated to a depth of about four feet, a portion of the soil from the upper side of the hole was dislodged, and a small quantity of the freshly uncovered soil received into a sterile tin box and immediately shut up therein. It is believed that no surface or air contamination reached any of the samples, the exposure of the portion of soil taken not lasting more than a few seconds; in each case care was taken that no soakage from above gained access to the portion to be examined, while the hole was being dug. The level at which the samples were taken was fixed at about 18 inches below the surface, this being the thickness of the layer of surface soil above the chalk; the chalk is here dense, and neither marly nor (except in the bed of the stream) mixed with flints.

Method of Preparation of Samples.—In the case of the first four samples, into a wide-mouthed stoppered bottle, previously cleansed with sulphuric acid, alcohol and water of known bacterial purity, 150 cc. of the same pure water were introduced, and then the sample of soil (about 100 grammes): the soil and water were well shaken up together, the heavy particles allowed to settle, and the clear water submitted to examination in measured quantities.

Subsequently, the more exact methods detailed by Dr. A. C. Houston (in the *Report of Medical Officer to the Local Government Board*, 1900—1901), were followed, with trifling variations. Into a sterile flask containing 150 cc. sterile water were introduced 15 grammes of the soil, weighed in a sterile watch glass and transferred as quickly as possible: the flask, called flask (1), was well shaken, and then allowed to stand for 15 minutes, to deposit the grosser particles. From this flask (1) ten cc. (= one gramme soil) were introduced into a similar sterilised flask, (2), containing 90 cc. sterile water, and well shaken up. From flask (2) again 10 cc. (=·1 gramme soil) were introduced into 90 cc. sterilised water in

flask (3), and well shaken. Cultivations were then made from flasks (2) and (3), and, if necessary, from flask (1).

In flask (1), one cc. = ·1 gramme soil.
In flask (2), one cc. = ·01 „
In flask (3), one cc. = ·001 „

Method of Examination.—The following points were sought to be determined: presence of coliform organisms: presence of *Bacillus enteritidis sporogenes:* presence of *Streptococci:* approximate number of spore-bearing organisms present; presence and, roughly, abundance or scarcity of organisms forming gas bubbles in shake cultures in ordinary gelatine.

Examination for Coliform organisms.—Glucose formate broth, incubated anaërobically in Buchner's tubes at 37·5°, was the routine method employed. In the later samples McConkey's bile salts broth was used in addition, similarly incubated anaërobically at 37·5°. If any growth appeared after 24 or 48 hours, gelatine plate cultures were prepared and incubated at 20°. Any coliform colonies were fished out and subcultured; in litmus milk for clotting and acid-formation; in broth for microscopic examination and production of indol; in gelatine shake culture for gas-formation. We consider a surface colony in gelatine to be coliform, when it is non-liquefying, colourless, flat, with an irregular margin, and more or less filmy in appearance, having fine markings on the surface. When such a growth is obtained from glucose formate broth, or bile salts broth incubated anaërobically at 37·5° or 42°, and is found to consist of organisms resembling *B. coli* morphologically, and decolorised by Gram's method, it may be considered as not only coliform in appearance, but as really belonging to the *coli* group. The ordinary tests can then be applied to differentiate between typical *B. coli*, typical *B. typhi*, etc.

Examination for B. enteritidis sporogenes.—One or more cubic centimetres of water, or soil-water, were sown into tubes of litmus milk, heated to 80° C. for fifteen minutes, in order to destroy all non-sporing organisms, and then incubated at 37·5° anaërobically in a Buchner tube. Coagulation of the milk, with formation of gas, producing a flocculent curd, and development of acidity, indicate *B. enteritidis sporogenes.*

Examination for Streptococci.—An agar plate having been allowed to set, 0·2 c.c. of soil-water was distributed over the surface, the culture being then incubated at 37·5°. Any minute colonies were examined microscopically, and if composed of cocci, were sub-cultured into broth. No streptococci were found in any sample.

Examination for Spores.—One or more cc. soil-water were sown into gelatine tubes, heated to 80° for 15 minutes, and plated; any resulting colonies would be derived from spore-bearing (aërobic) bacteria.

Examination for gas-forming bacteria.—Shake cultures were made in gelatine, and incubated at 20°.

SERIES A.—SAMPLES OF WATER.

No. 1.—*Water from hole in bed of Nine Mile River.*

Sample taken 22nd July, 1902. This hole was dug opposite the sewage-irrigated area. *B. coli* found in three cc., but not *B. enteritidis sporogenes.*

No. 2.—*Water from hole in bed of same stream.*

Sample taken 22nd July, 1902, within six yards of No. 1. *B. coli* found in three cc., but not *B. enteritidis sporogenes.*

No. 3.—*Water from Nine Mile River.*

Sample taken 7th August, 1902, from pool just above the bridge. Most of the water at this point is derived from the soil, the stream only appearing above ground a few yards higher up. *B. coli* (a variety producing acid, but not clotting milk) found in one cc. *B. e. sporogenes* not detected in 5 cc. Spores and gas-forming bacteria numerous.

No. 4.—*Water from stream.*

Sample taken 7th August, 1902, from near No. 1. An organism was isolated from 5 cc., capable of growing in glucose formate broth anaërobically at 37·5°, and forming typically coliform colonies in gelatine plates; causing clotting of milk and producing acid, but only slightly and slowly; fermenting glucose and producing gas bubbles in shake culture. Microscopically it resembles *B. coli*, but it is not decolorised by Gram's method, and does not produce indol. *B. e. sporogenes* not detected in five cc.; a few gas-forming bacteria; number of spores small.

No. 5.—*Water from hole on left bank of stream.*

Sample taken 7th August, 1902. This hole was in line with the holes whence soil samples Nos. V. and VI. were taken, and about six feet from the actual river bed; water was reached at a depth of 4 feet. *B. coli* found in one cc. (a variety producing acid, but clotting milk imperfectly). *B. e. sporogenes* not detected in 5 cc. Spores and gas-forming bacteria numerous.

No. 6.—*Water from hole in bed of stream.*

Sample taken 7th August, 1902. This hole was dug in the bed

of the stream three furlongs higher up than the sewage-irrigated area, and about 50 yards below Sheepbridge Cottages; water was reached at a depth of two feet. A coliform organism detected in five cc., resembling *B. coli* in its growth in glucose formate broth, on gelatine plate, and in milk, producing acid and indol, forming gas bubbles in shake culture and H_2S in lead broth, but not decolorised by Gram's method. *B. e. sporogenes* not detected in five cc. Number of spores and of gas-forming bacteria small.

Series B.—Samples of Soil.

No. I.—Sample taken 22nd July, 1902, from hole about 10 yards below main sewage carrier. *B. coli* found in three cc. soil water (= two grammes soil nearly); *B. e. sporogenes* not detected in same quantity.

No. II.—Sample taken 22nd July, 1902, from hole 35 yards below No. I. *B. coli* and *B. e. sporogenes* found in two grammes soil.

No. III.—Sample taken 22nd July, 1902, from hole about 70 yards below main carrier. Neither *B. coli* nor *B. e. sporogenes* detected in two grammes soil.

No. IV.—Sample taken 22nd July, 1902, from hole about 20 yards below main carrier in western section of irrigated land. *B. e. sporogenes*, but not *B. coli*, found in two grammes soil.

No. V.—Sample taken 7th August, 1902, from hole 53 yards below main sewage carrier, and 10 feet below lowest point on the surface to which sewage had been applied (as shown by exuberant growth of rye grass). Neither *B. coli* nor *B. e. sporogenes* were found in ·1 gramme soil; number of spores large; gas-forming bacteria not abundant.

No. VI.—Sample taken 7th August, 1902, from hole 67 yards below main sewage carrier, exactly in line with hole No. V., and 50 feet below the lowest spot on the surface to which sewage had actually been applied. Neither *B. coli* nor *B. e. sporogenes*, nor any gas-forming bacteria found in ·1 gramme soil; number of spores large.

Series C.—Samples of Subsoil.

First Group.—Samples taken 14th October, 1902. The ground over the tunnel had been irrigated with sewage for two years previously. In each case the chalk appeared to be perfectly clean and almost dry.

No. i.—Sample taken from head of tunnel, nine feet below surface and 91 feet from sewage-carrier. Neither *B. coli* nor *B. e. sporogenes*, nor gas-forming bacteria detected in ·2 gramme; very few spores found.

No. ii.—Sample taken from middle of tunnel, six feet below surface and 121 feet from sewage-carrier. Same as No. i.

No. iii.—Sample taken from near mouth of tunnel, four feet below surface, and 151 feet from sewage-carrier. Same as No. i.

Second Group.—Samples taken 25th November, 1902. The ground overlying the tunnel had been deluged with sewage for the preceding 14 days.

No. iv.—Sample taken at head of tunnel. The chalk was apparently clean and white, but very moist. From one cc. of soil-water, Flask (2) (= ·01 gramme), a coliform organism was isolated, growing well in glucose formate broth anaërobically, with considerable formation of gas and forming colonies on gelatine plate that are typically coliform for seven days, after which they lose the filmy appearance and become raised: producing acid, coagulating milk, forming gas bubbles in gelatine shake culture, blackening lead broth, and reddening bile salts broth; microscopically it resembles *B. coli*, and it is decolorised by Gram's method. It does not produce indol. In the further dilution, Flask (3), (1 cc. = ·001 gramme) what is apparently the same organism is not decolorised by Gram's method, but the gelatine plate cultures are typical, and it answers to the tests mentioned, though with no indol formation. *B. e. sporogenes* not detected in ·01 gramme; number of spores and gas-forming bacteria small.

No. v.—Sample taken from middle of tunnel. The chalk was very moist, and had an appreciable mixture of light brown soil. From one cc. of Flask (2) (= ·01 gramme) a coliform organism was isolated, growing well in glucose formate broth anaërobically with considerable gas formation, and forming colonies on gelatine plates that are typically coliform for four days, after which they lose the filmy appearance and become somewhat raised; it forms gas bubbles in gelatine shake culture, and reddens bile salts broth; it does not clot milk, does not grow in lead broth, does not form indol, and does form a slight pellicle in broth; microscopically it resembles *B. coli*, but is not decolorised by Gram's method. *B. e. sporogenes* was not detected in ·01 gramme; number of spores and gas-forming bacteria very small.

No. vi.—Sample taken near mouth of tunnel. The chalk was very wet but clean and white, with no admixture of soil. No coliform organisms, nor *B. e. sporogenes* detected, even in ·1 gramme chalk; number of spores and of gas-forming bacteria very small.

Third Group.—The foul water having been applied over the whole irrigated area in regular rotation (not excessively over any one plot) during the months of December and January, further samples of subsoil were taken from the tunnel on 3rd February, 1903, and examined as before.

No. vii.—Sample taken at head of tunnel. The chalk is clean and apparently almost dry. From one cc. of Flask (2) (= ·01 gramme) a coliform organism was isolated, growing well in glucose formate broth anaërobically, with slight gas formation, forming typical coliform colonies on gelatine plates, producing acid, forming gas bubbles in gelatine shake culture and reddening bile salts broth; but not clotting milk, not forming indol, and not blackening lead broth; microscopically it resembles *B. coli*, and it is decolorised by Gram's method. *B. e. sporogenes* was not detected, number of spores small, gas-forming bacteria absent.

No. viii.—Sample taken from middle of tunnel. The chalk is rather moist and friable. From 5 cc. of Flask (2), (= 0·05 gramme) a coliform organism was isolated, growing well in glucose formate broth anaërobically, with considerable gas formation, forming somewhat coliform colonies in gelatine plate-cultures (but not typically coliform), producing acid, clotting milk (but slowly), forming gas in gelatine shake culture and reddening bile salts broth; microscopically it resembles *B. coli*, but it is not decolorised by Gram's method, nor does it form indol, nor blacken lead broth. *B. e. sporogenes* was not detected, number of spores small, and gas-forming bacteria absent.

No. ix.—Sample taken near mouth of tunnel. The chalk is rather moist and friable. No coliform organisms and no *B. e. sporogenes* detected, number of spores small, no gas-forming bacteria.

Fourth Group.—Foul water, with some water-closet sewage, was applied regularly over the irrigation area during 1903. Further samples were taken 8th December, 1903. All appeared clean and sweet. The examinations were made the same way as in last group. No traces of coliform organisms, no *B. e. sporogenes*, and no gas-forming bacteria were detected in any sample. In Nos. x. and xii. (head and mouth of tunnel) spores were few in number: in No. xi. (middle of tunnel) they were rather numerous.

The above examinations were conducted in the Bacteriological Laboratory of Guy's Hospital, by the courtesy of Dr. J. W. H. Eyre.

Mr. W. Whitaker (London) said that to mention chalk in his presence was like waving a red flag before a bull. In the south of England the chalk was their best water-bearing formation, from which nearly all their large supplies came. Therefore, they had religiously to look after it, and to see that no pollution came to it, or if such occurred that it should be treated in such a way as to be harmless. There was one good fundamental rule with regard to sewage-disposal on chalk soil: that the authority should not put it on its own soil, but on some one else's. Secondly, that it should not be put near a waterworks. Some years ago there was a little sewage-installation belonging to the War Office, in which the sewage was put on to the chalk direct. It was got rid of very easily, but the place was not one on which sewage should be put having regard to the water supply. Curiously enough, the only waterworks near was one put up for the War Department, and prompt measures were taken to have a better scheme. He was in the district at the time, and suggested that the right thing to do was to take the sewage from within their own area and put it outside their fortifications, where it would do harm to the enemy. This paper was the subject of research by officials of the War Office as to the disposal of sewage on chalk soil, where they could not help putting it on chalk soil, and they must all welcome investigations of that sort, which would enable these officers to give advice to the War Office as to the disposal of the sewage of what was practically a large camp. The work seemed to have been very carefully done, and they had found out what would happen in certain circumstances.

Lieut.-Col. A. M. Davies (London) said that they had had the opportunity of having a tunnel driven through the side of the hill on which the sewage was disposed of, and therefore they had been able to see what went through so many feet of chalk. They found sewage bacteria which had come through nine feet of chalk. A little lower down, sewage bacteria were also found, but lower down again they were not found. That was after the ground had been deluged with sewage for fourteen days. That showed that sewage bacteria could get down through nine feet of chalk. For two years before that, sewage had been applied to the ground in the ordinary way, but they could find no sewage organisms in the tunnel to have come from that. After the deluge of sewage had been carried on for fourteen days, a further period of two months was allowed to elapse, when the sewage was applied in the ordinary way. An examination was then made, and sewage organisms were found still to be present. After another period of eleven or twelve months when sewage was applied in the ordinary way no sewage organisms were found, which seemed to show that sewage organisms were able to live in the chalk for a moderate time, but did not live for ever.

THE POLLUTION OF RIVERS BY THE SLUDGING OF MILL-DAMS.

By ARTHUR F. SOMERVILLE,
Chairman of the Sanitary Committee of the Somerset County Council.

THIS question is one which is practically outside the question of pollution of rivers by sewage or manufacturers' waste, and arises from the obstruction to the flow of water by the interposition of a weir or mill dam.

The law on this subject is at present very unsatisfactory and conflicting; for, while on the one hand it has been decided, by the well known case of the Glory Mill, that an "inferior" riparian owner can recover damages for the destruction of his fish through the sludging of a mill dam by a "superior" riparian owner, on the other hand the courts have held that the mere sludging of a mill dam is not an offence within the meaning of either the Rivers Pollution Prevention Acts or the West Riding Rivers Board Act, 1894. Under section 2 of the Rivers Pollution Prevention Act, 1876, which deals with pollution of rivers by the throwing into them solid matter other than sewage, it is an offence "to put or to permit to be put, or to fall or to be carried into any stream . . . . so as to interfere with its due flow, or to pollute its waters . . . . . any putrid solid matter."

"Solid matter" is further defined by this Act to be other than "particles of matter in suspension in water." Sec. 17 of this Act also provides that the Act shall not apply to or affect the lawful exercise of any rights of impounding or diverting water. In the case of the River Ribble Joint Committee *v.* Helliwell, the Court of Appeal held that solid matter in suspension did not change its character by precipitation, and that the throwing of such precipitated matter in the form of sludge into a stream was not an offence within the meaning of sec. 2 of the 1876 Act.

In the case of the West Riding Rivers Board *v.* Messrs. Goldthorpe & Hinchliffe, Bull House Mill, Thurlstone, decided 28th October, 1897, and

in that of the same Board *v.* Messrs. Rawson, Thorpe Mill, Ripponden, decided 10th July, 1903, the evidence was very similar.

It was proved in both cases that the defendants raised their hatches and employed men with rakes, shovels, and barrows to remove the sludge deposited in their dams, and that they then threw this sludge into the stream, by which it was carried by the water down the river. The water of the river was made thick and turbid, causing injury to the riparian owners below, and for some miles down the water of the river was discoloured.

In both cases it was argued for the defence that, inasmuch as the defendants had put nothing from their mills into the dams—this was admitted by the prosecution—but had merely sent down matter brought into their dams by the flow of the river, such matter came within the exception laid down by sec. 6 of the West Riding Boards Act, 1894. Under sec. 5 of that Act it is an offence to cause or to permit to be put into any river or stream, within the district covered by the Act, "any solid refuse or any rubbish, or any *deposit* in a reservoir, mill dam, or water lodge."

Sec. 6 excepts from the provisions of sec. 5 any "sand, gravel, or *natural deposit*."

In both cases the Court of Appeal upheld the defendants' contention that this sludge was a "natural deposit," and therefore came within the exception provided by sec. 6: the prosecutions consequently failed.

It seems to follow from these three decisions, that one of the rights connected with the impounding of water is the right to remove from the pound or mill dam by sludging any matter which has been brought down into the dam by the natural flow of the stream. It would also appear that the right to sludge is subjected to no restrictions. The deposit may be allowed to accumulate over a period of several years, and may then in the course of a few days be thrown into the stream, or this sludging process may be carried on intermittently at the discretion of the owner of the dam.

It may perhaps be argued that, though no action can be taken under the Rivers Pollution Prevention Act, or the West Riding Rivers Board Act 1894, for sludging, there still remains the common law right to sue for damages. But, even if this be so, it is often extremely difficult to prove and estimate the special damage caused by sludging, however real it may be.

That it is a cause of real damage I can testify from personal experience, having suffered much from sludging of mill dams in recent years, and this year especially, when, for nearly three months, an otherwise fairly

clean stream was turned into a foul stinking sewer, by the sludging of a large mill dam, where the sludge had been accumulating for some years.

In rural districts, such as the one I live in, dairy farmers suffer much loss from sludging, by injury to their cattle and the deterioration of their milk, butter and cheese, while the villagers have their water supply, upon which they have to depend for all purposes, except drinking and cooking, rendered totally unfit for use.

A few years ago sludging was rarely, if ever, resorted to in this district, the general custom being to dig out the sludge and to remove it by hauling it away to be spread over the land.

It is merely to save expense, to decrease working expenses, and thereby to increase profits that mill owners have now changed their method of cleansing their dams, and have resorted to this intolerable nuisance of sludging, quite regardless, of course, of the injury they are causing riparian owners below them, or of the possibility that sickness and death may be the result of their selfish action.

It is, moreover, a very serious question whether or not these recent decisions of the Court of Appeal have not only rendered the Rivers Pollution Prevention Acts a dead letter with respect to a most serious form of pollution, but have also laid down a principle which may affect future proceedings under the common law for damages.

With all due deference to their lordships, it appears to me that they have entirely missed the point that a weir or mill dam, while it gives certain advantages to, ought in equity to impose certain liabilities on, the owner of the dam. The obstruction to the flow of water which the interposition of a dam or weir creates, is a cause of injury to riparian owners below and to the public generally, in that, as Mr. A. G. Leigh pointed out in his paper on "The control of weirs and dams on streams in relation to river pollution," the self-purification of streams, where there is a succession of dams, is impossible; "oxygenation and bacterial action cannot appreciably improve a stream the water of which is being constantly contaminated by contact with a succession of partially-stagnant filth pits;" and he then laid down the principle that "those, who get the advantage by impounding their water, should also bear the disadvantage of cleansing their dams in a proper manner."

It is not true, moreover, as was contended by the respondent's counsel in the Goldthorpe case, that deposited mud does not change its character by deposition. The Court of Appeal, however, accepted the theory that no change can take place, in spite of the evidence of Mr. Thos. Fairly, of Leeds, who proved that the sludge in question contained a large amount

of putrid organic matter—"the most polluting substance to put into any stream."

Another point, which one would have thought would have carried weight with the court is, that to allow matter to accumulate for, it may be, years, and to then send it down a stream in almost a solid mass, must render the water of that stream unfit for use, while to allow the same matter to gradually flow down in suspension would hardly change the character of the water or affect its use.

The general principle, which has been laid down by law from time immemorial, that in the user of water the "superior" riparian owner has no right to either diminish the volume or to change the character of the water to the damage of the "inferior" riparian owners, seems to be now entirely swept away by these decisions.

It is a question of the highest importance to a large number of the public as well as to riparian owners, and I should like to suggest that the special attention of the Royal Commission, which is now dealing with the prevention of pollution of rivers, be directed to it, and that they be asked to introduce further legislation with a view to the removal of a grave injustice to private individuals, an injury to the public, and a possible danger to water supplies.

THE MANAGEMENT OF SEWAGE DISPOSAL WORKS.

By ARTHUR J. MARTIN, M.Inst.C.E.,
(Member.)

IN the summer of 1896 the author had the privilege of reading, at a Congress in Glasgow, a paper contributed by Mr. Cameron, entitled "Some Recent Experiments in Sewage Treatment at Exeter." The principle embodied in these works, novel and even revolutionary as it was, is now firmly established as the basis of current practice in sewage disposal.

The triumph of the bacterial principle has been followed, as was only natural, by a keen controversy as to the mode in which it could be most advantageously employed. The fight, so fiercely waged, between the septic tank and the coarse bacteria bed, is fresh in our memories, and the din of the battle between the contact bed and the trickling filter is still in our ears.

In the present paper the author proposes to leave both these bones of contention severely alone, and to call the attention of his hearers to one or two factors in the question of sewage disposal which are too often overlooked.

We hear of places where highly satisfactory results are obtained from chemical precipitation followed by double contact, and we are told that precipitation and contact are the best and most efficient means which can be used. In other cases this combination has failed to give satisfactory results, and septic tank installations have been employed, to the great satisfaction of the authorities concerned. Here we are told that precipitation is useless, and the septic tank system the only one which should be allowed. Other instances will recur to most of us in which certain processes, or combinations of processes, have proved efficient or the reverse, and their success or failure has at once been made the ground for the most sweeping generalisations as to the merits of the systems involved.

In all this, it seems to the author, one most important factor is overlooked. When we hear a charming solo on the violin, or are driven to distraction and profanity by an atrocity perpetrated on the same instrument, we do not as a rule think first of the pattern or make of the instrument,

but our gratitude or homicidal rage, as the case may be, is directed towards the performer. In the matter of sewage disposal, also, results depend not only on the merits or defects of the system used, but also, and in no less degree, on the way in which it is applied. There is no system so perfect as to yield good results under all kinds of manipulation, and there is probably none in use to-day which is so bad as to be incapable in skilful hands of yielding at least tolerable results. Success, therefore, depends in great measure on the design and construction of the works, and to an even greater degree upon their management.

The management of sewage works is a matter of supreme importance from a ratepayer's point of view, for there is probably no class of municipal work in which shortsighted attempts to save the rates by the employment of an incompetent manager have led in the end to the squandering of larger sums of money.

It is also an engineer's question, for inefficient management of sewage works has not only wrecked many a well-devised scheme, but in doing so has done grievous harm to the engineer who designed it.

To a large town, and especially to a city such as Glasgow, the salary of an efficient sewage works manager is a bagatelle, though it is not always an easy matter to find the man. In smaller places, however, it is no trifle to pay such a man, though it is cheaper in the end to do so than to put up with incompetent management. When we come down to villages of 500 people (and even smaller places have their sewage works now) it is out of the question to expect something like one per cent. of the adult male population to be devoted to the work of sewage disposal. In order, therefore, to bring sewage purification works within the reach of small communities, some way must be found to bring the labour bill within reasonable bounds; in other words, automatic working must be resorted to.

Automatic working was first adopted by Mr. Cameron in 1895-6 in connection with the original septic tank installations laid down at Exeter. The first and smaller of these comprised two filters only, each receiving the sewage in turn, and being discharged automatically immediately it was full. In the larger works, which serve 1,500 people, there are five filters, four of which form the working set, the fifth being held in reserve. Each filter was filled in turn, and held full while the next was filling, its discharge being effected by an overflow from the latter. This method of working is open to the objection that the time during which a filter is kept full is not constant, but is governed by that required to fill the next filter; so that at night, when the flow is small, a bed may be kept full for six hours, or even more. In spite of this and other drawbacks, the

effluent from the filters was sufficiently good to excite the admiration of all who saw it; and, what was more to the point, the Local Government Board, after an inquiry lasting three days, and a protracted consideration of the evidence, came to the conclusion that the results were sufficiently promising to justify a loan for laying down works on the same system for the whole city. It is true that the scheme was sanctioned as "an experiment"; but one does not require to have much acquaintance with the practice of the English Local Government Board to realise that an expenditure of £42,000 would not have been sanctioned had the Board considered that there was any serious risk of failure.

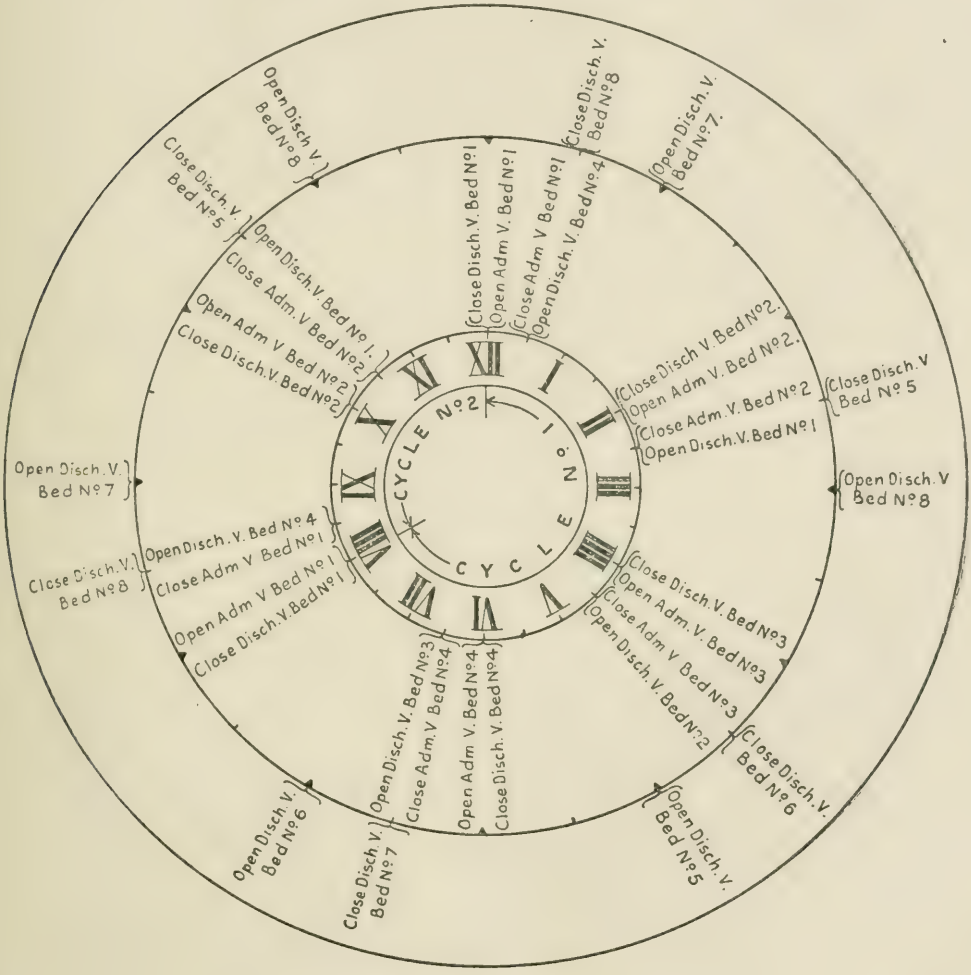
It was, however, felt that, to obtain the best results, the duration of the contact should be fixed instead of variable, as in the installations above referred to. A new type of apparatus providing for a fixed contact, but in other respects similar to that used at Exeter, was accordingly devised.

Among the earliest works to be fitted with alternating gear (as it was called) in which a timed contact was provided for, were those at Barrhead, which form the subject of Mr. Shanks' very interesting paper. Since this installation was laid down the apparatus has been considerably improved and simplified. The types in use at Exeter and Barrhead comprised a number of valve-seats and bearings which had to be set independently, and any error in doing this was apt to cause binding and consequent uncertainty in working. The lineal descendants of the Barrhead apparatus are therefore as a rule self-contained; that is to say, each set is erected on its own bed-plate, and is thus independent of errors in setting. So far, the author has referred exclusively to the apparatus made under Mr. Cameron's auspices, and with which he himself is more particularly acquainted; but it is only right to add that other types of apparatus have been introduced to do the same work. From an historical point of view, however, it is only necessary to refer to Mr. Cameron's, since to him is due, not only the introduction of automatic working, but also that of the fixed contact, the lack of which had been regarded as the weak point of automatic apparatus.

One frequently hears it assumed by those who are not conversant with the practical work of sewage purification, that the object of using alternating gear is merely to save the wages of the labourers who would otherwise be required to open and close the valves. No greater mistake could be made; for although the wages of two or three men are no light matter, at all events to a small town, the point which the users of automatic machinery have chiefly in view is to eliminate the element of uncertainty

which is ordinarily inseparable from manual control. It is not always realised how much work is involved in the mere operations of opening and closing the supply and discharge valves of a set of filters. For the purpose of illustrating this graphically the author prepared some time ago a diagram, which is given below, showing the operations to be

Diagram of work to be done in opening and closing the Valves of a Set of 4 Primary and 4 Secondary Contact Beds.



Primary Beds numbered 1 to 4.
Secondary „ „ 5 to 8.

performed in connection with a set of four upper and four lower contact beds, supposing each to be filled and emptied three times in the twenty-four hours. The work required in connection with the upper beds only, is as follows:—

Midnight.	Close discharge valve and open admission valve of filter No. 1.
12.30	Close admission valve of filter No. 1. Begin to open discharge valve of filter No. 4 (previously filled), and open wider every five minutes for, say, twenty minutes.
2. 0	Close discharge valve and open admission valve of filter No. 2.
2.30	Close admission valve of filter No. 2.
to 2.50	Open discharge valve of filter No. 1.
4. 0	Close discharge valve and open admission valve of filter No. 3.
4.30	Close admission valve of filter No. 3.
to 4.50	Open discharge valve of filter No. 2.
6. 0	Close discharge valve and open admission valve of filter No. 4.
6.30	Close admission valve of filter No. 4.
to 6.50	Open discharge valve of filter No. 3.
8. 0	Close discharge valve and open admission valve of filter No. 1.
8.30	Close admission valve of filter No. 1.
to 8.50	Open discharge valve of filter No. 4.
10. 0	Close discharge valve and open admission valve of filter No. 2.
10.30	Close admission valve of filter No. 2.
to 10.50	Open discharge valve of filter No. 1.
Noon.	Close discharge valve and open admission valve of filter No. 3.

And so on during the next twelve hours.

For the purpose of this table it has been assumed that the discharge valves are opened gradually, as recommended by some authorities, and as may be done automatically if so desired. If the valves are opened to the full extent at once, a little time will be saved; but even then the caretaker must never be away from the filters for more than an hour and a half at a time. For the sake of brevity, only the operations necessary in connection with the upper filters are set forth in the table. If to these is added the work of opening and closing the discharge valves of the lower beds, it will be seen that the caretaker will have plenty to do. This time-table holds good only when dealing with the wet weather flow. In dry weather the beds will be filled and discharged less frequently, but it does not follow that the work will be less exacting on that account. On the contrary, the man in charge, having an irregular instead of a regular

flow to deal with, will not be able to follow a fixed time-table, but must remain at his post to watch for the proper time to open and close the valves; and it will be the exception rather than the rule for the time for beginning to fill one filter to coincide with that for beginning to discharge another, as it has happened to come in the time-table. The temptation to save himself trouble by slurring over the work would always be a strong one; and the probability is that a sudden storm flow, caused by a summer shower, when the sewers would be foulest, would not always find the caretaker at his post, especially if it happened to come down at night. The circumstances under which most councils are placed are not such as warrant them in running such risks.

In a large installation there will generally be more than four filters at each level, in which case the work will be proportionately increased. The actual physical work of opening and closing the valves is not heavy, but the tax on a man's vigilance is considerable. In considering the cost of manual control, it should be remembered that the work has to be done on Sundays as well as weekdays, and at night as well as by day.

Automatic working is sometimes objected to on the ground that it substitutes a mere machine for the human intelligence by which it is urged that each operation should be directly controlled. It is contended that the rates of filling and discharging, and the period of contact, instead of being fixed, as they generally are in automatic working, should be varied from time to time to correspond with the changes in the composition and strength of the sewage. To anyone familiar with the sewage of manufacturing towns, which, as may be seen at Dalmarnock, often changes its character completely from one hour to another, the need for constant changes in the kind and quantity of the precipitants used is obvious. This argument will seem a reasonable one, and it should be remembered that even an ordinary domestic sewage, containing no manufacturing waste liquors, generally shows wide variations in composition and strength in the course of the twenty-four hours. In most bacterial works, however, the sewage, before reaching the filters, has to pass through a tank, generally a septic tank, which holds a whole day's dry weather flow; and experience has shown that the effluent from such a tank is practically constant in composition throughout the day, in spite of the changes in that of the sewage. The beds have thus to deal with a liquid of nearly uniform strength. The rate of flow also may, if so desired, be equalised by modules, as at Barrhead, or by other suitable means, thus rendering the work of the filters constant in both respects.

No one will deny the need for intelligence in the centre of the

working of a bacterial installation, but most engineers will probably agree with the author in his opinion that it is more conducive to efficiency that the intelligence in question should be that by which the works were designed than that of the labourer who is often promoted to the important office of manager. From an engineer's point of view, therefore, an apparatus which insures the working of an installation in harmony with its design and his intentions is a safeguard of no mean order.

The value of automatic working has been recognised by the Local Government Board for England in their rules with respect to the capacity of contact beds, which permit three fillings per day where it is used, and two only where manual regulation is resorted to.

It must be admitted, however, that automatic working has its drawback, which lies in the temptation under which it places a parsimonious local authority to leave their sewage works absolutely without attention. One little installation with which the author was concerned was left severely alone for eight weeks. Towards the end of this period, whether through newness of the bearings, or some accidental cause, the gear came to a standstill, much to the indignation of the council. After this, however, it became possible to convince them that even an automatic installation should be kept clean and treated to a drop of oil once a week. The village postman was accordingly installed as caretaker, and has since discharged his duties in a thoroughly efficient manner for the munificent salary of half-a-crown or five shillings per week.

The author has so far confined his remarks to contact beds, not that he is oblivious of the merits of trickling filters, but for the simple reason that, so far as he is aware, the desirability of working the latter automatically has never been questioned. The most ardent advocate of the human intelligence would hardly suggest the substitution of a man with a hose or watering-pot for the automatic distributors, fixed or otherwise, by which the supply of effluent to such filters is invariably controlled.

In the evidence published with the Reports of the Royal Commission on Sewage Disposal, now sitting, reference is made to the practice, formerly common among local authorities having sewage farms, of letting the latter to farmers; and the opinion is strongly expressed that a council should always keep the disposal of its sewage in its own hands. The importance of this, where land treatment is resorted to, with its constant temptation to subordinate the purification of the sewage to the interests of the crops, cannot be gainsaid; but the author's experience leads him to think that where artificial works, whether biological or otherwise, are concerned, there may be instances in which it is desirable that a council

should be authorised to entrust them to other hands. It often happens that there are several villages or small towns within easy reach of one another, having sewage works, the whole of which could be easily kept in order by one man. Theoretically, this man might report to a joint committee of the authorities concerned; but from what the author has seen of the feelings which neighbouring authorities entertain towards one another, he is by no means sanguine that such an arrangement would work in practice. Where, as often happens, all the works are on one system, and the firm which supplied the automatic apparatus is willing to take charge of them, the interest which such a firm has in the results from the installations would afford the best security for their efficient management. The application of this principle is not limited to works on bacterial lines, for of all the precipitation plants in the country there is probably none better managed, nor effecting a higher degree of purification, than that at Kingston-on-Thames, which, as is well known, is in charge of the company whose system of precipitation is employed there. For the benefit of any advocates of municipal trading who may be present, and whose consciences will not tolerate the intervention of any private body in public matters, the author may mention an alternative means of providing an independent check upon the management of sewage works. This consists in instructing the engineer from whose design and under whose supervision the works were laid down, to pay a visit of inspection, yearly, half-yearly, or quarterly, as may be desired, and preferably without notice to the caretaker. A well-known engineer, who gave evidence before the Royal Commission, mentioned that he made a practice of arranging for such a visit in the case of works with which he was connected, and the author, wherever possible, does the same.

Seeing how vital it is to the efficiency of purification works that the management should be in harmony with the design, it is strange that local authorities themselves do not make a point of arranging for such a system of inspection.

CONGRESS AT GLASGOW.

CONFERENCE OF MUNICIPAL REPRESENTATIVES.

THE SMOKE PROBLEM.

Introductory Remarks

By SIR JOHN URE PRIMROSE, Bart.,

The Hon. the Lord Provost of Glasgow.

IT is eight years ago (1896) since, at a Congress of somewhat similar magnitude, the problem of smoke pollution and its remedies was brought forward and discussed. It was keenly and brilliantly touched upon by the President of the Chemical and Engineering Section in his opening address on the subject of "Light and its Influences." I remember well how we all sat in the Bute Hall, like people entranced, drinking in the illuminating periods which fell from Professor, now Sir William Ramsay. Sir William has travelled far in the regions of science since then. As a discoverer in the sphere of luminosity and radio-activity he stands now among the foremost, and to-day he has reached the inner recesses of nature's mysteries, where radium and helium combine to point the way to an unthought-of solution of the making and unmaking of worlds. We had also a most instructive paper from Mr. Alfred F. Fletcher, H.M. late Chief Inspector under the Alkali Acts, in which he fully surveyed the ground from the engineering and technical standpoint.

Doubtless these two addresses did much to attract public attention to smoke pollution and its dire effects; and we have also travelled, during the eight intervening years, considerably nearer towards a final solution of the problem. Still, much of what these two gentlemen told us at that time is equally true now: eight years is as but a moment in the distance of time we have yet to go before all our manufactories and all our domestic

NOTE.—The Proceedings of the Conference commenced with an Address by COUNCILLOR W. F. ANDERSON, J.P. (*see page* 291).

fires cease to be the "enemies of cleanliness and the supporters of disease."

Not being a chemical and physical scientist, nor an engineering expert, all I can do to advance the good cause is to reiterate, in the best manner I can, the great lessons then taught, and to indicate the position of the problem to-day, and the steps which all authorities might reasonably take to bring home to the minds of the general population of this kingdom the importance of the subject. Having done this, I may safely leave the matter for discussion in your hands, as there must be many before me whose experience and expert knowledge will make complete what I imperfectly fulfil or leave undone.

Sir William Ramsay, in the address I have alluded to, referred to one point in connection with smoke production which cannot be known too widely. He said: "Smoke condenses atmospheric vapour, causing fog and rain, renders our climate colder, and makes our lives more or less unhappy and uncomfortable. It shuts out sunlight, and thus increases the growth and tends towards the multiplication of bacteria, many of which are of a dangerous character."

Thus, as he stated, "we have, to some extent, the very rainfall under our control." Now, gentlemen, that is a very comforting suggestion. There are certain places in the world, notably Australia, where the ingenuity of man is invoked to cause rain; where the brazen heavens have been attacked by bombs and explosive air-ships, in order to wring out a life-giving shower from the arid air. I sincerely wish that some one would invent a method whereby Glasgow, Sheffield, Birmingham, and some other of our darker communities could despatch to such districts our rain-compelling smoke. We would not ask any financial return for our export. Even in the summer-time in Glasgow we have, taking averages, rain on two days out of every three, and our sunshine is all too scanty. When we see the clouds rolling over us, making the sun invisible and soaking us with moisture, we are apt to blame those mysterious visitors called cyclones, V-shaped or otherwise, forgetting that these are but moving centres of atmospheric depression, which render the air incapable of sustaining the moisture it contains. But we know from the valuable experiments of Mr. John Aitken, of Falkirk, that before this moisture can form into rain-drops it must be supplied with particulate matter in the form of dust, either as smoke, fine dirt or sand, bacteria, or concentrated salt from the sea-spray. Round about these minute particles the moisture condenses and falls to earth as rain.

Thus, in a certain measure, every community that loads its atmosphere

with smoke is preparing, either for itself or for other people, those multitudinous condensers, without which the moisture in the atmosphere could only come to us as "the gentle dew."

But even more important from the public health point of view is the formation of fogs, which make all those who dwell in cities, and can afford it, flee therefrom to the country, or, at any rate, far enough into the environs to escape from that yellow, all-enshrouding quality of fog which is so utterly disagreeable and dangerous. We are all well aware, from the abnormal rise of the death-rate of towns during a continuance of fogs, how they act as aggravators of disease conditions—how bronchial and phthisical subjects especially suffer; but now we know that the intensification of fogs by the admixture of smoke emissions directly incites disease, by absorbing from the rays of the sun the blue, violet, and ultra-violet light, which has been discovered to be fatal to all bacterial life. Thus, directly, as well as indirectly, the public health is deteriorated by our present methods of coal combustion, and we cannot doubt that, to a considerable extent, through scientific investigation, public lecturing, the comments of the public press, and official action, backed up by legislative sanction, much has been done in recent years to lessen the evil. Still, as sanitarians, we cannot rest content so long as we find our city air so contaminated, and, in turn, so contaminating, in comparison with that of the country.

It is common experience that, in the country, our houses, furniture, clothing, and persons continue for days to preserve a cleanliness quite impossible to secure under city conditions. After a holiday, and on returning to town life and struggle, we all know how our noses at once perceive the change from the fresh to the stale; from the dust-free to the dust-laden; from the invigorating ozone to the depressing and biting sulphur. We have been so long accustomed to accept this state of matters as one of the penalties of city existence, and to regard it as of the nature of the inevitable, that, after the first feeling of uneasiness and resentment is over, we settle down into a dull state of resignation, and partially forget all about it. It is not till a prolonged fog again envelops us in its asphyxiating embrace that we cry out in our distress for the removal of the "smoke fiend." How is this?

I much fear it is because that great touchstone, the public conscience, has not yet thoroughly gripped the fact that smoke is in reality a sapper of health, and not merely a necessary inconvenience, a penalty to be paid for the benefit of dwelling in an industrial community. I believe that once the mass of our city dwellers come to realise the disease-bearing

properties that lurk in the smoke-pall which enshrouds them day after day, we may expect the inertia, which now retards progress, to disappear, and instead receive from them the momentum which will insure a sweeping reform.

It is with this object in view that I have ventured to open the discussion to-day upon this subject. I am not able to find in the records of civic sanitary progress that scientific attention has been universally applied to an elucidation of the problem, and the effects of a smoky air on our towns.

There is no want of attention to the observation and careful tabulation of towns' death-rates, both general, special and infantile, for comparative purposes. Great attention has in recent years been paid to sewage treatment and disposal, and quite recently a Special Commission was appointed by Parliament to make an exhaustive enquiry into, and a report upon, this important question. I find scattered throughout the journals dealing with questions of public health, scientific data on the treatment of sewage, and the quality of the resultant effluents in various parts of the kingdom. I observe that the problem of the housing of our poorer classes, both in towns and in rural districts, has been receiving increasing notice, and that social reformers, medical men, architects, and even statesmen have been devoting themselves to its solution, and writing and speaking voluminously upon it. I rejoice to see that the condition of the operatives in all workshops and workplaces has in recent years been engrossing the attention of our Government, and particularly that of the Home Office. The question of shop employees and their hours of labour is also kept well to the front, and there are several Bills now under consideration for the amelioration of their condition. All along the line of sanitation, and particularly in that dealing with the health and well-being of our industrial population, I seem to note the march of progress, and to hear the sound of warfare against present evils; only on the state of the air, which the people are compelled to breathe, I fail to find any reliable data, or to hear of any serious or responsible movement being attempted to secure amendment.

We can obtain reliable information all over the country as to the rainfall, and the temperature is duly recorded day by day in every important centre of population. On the smut-fall statistics are silent. Why should this be?

It cannot be because of the comparative unimportance of a clean atmosphere as against a clean river or stream. It cannot be that it is more important to note and tabulate the effects of certain diseases among the population than to make records as to the causes of these effects. It cannot be that the careful marking of the inches of local rainfalls is

considered more essential than a careful analysis of the solid constituents that the rain washes from the air into the rain-gauges.

I cannot answer my own question. All I know is that among the multitudinous array of facts and figures continually laid before us, both in official and non-official documents, I have no acquaintance with any which would enable us to know the quality of the air of London as against that of Liverpool, or the smut-fall of Manchester in comparison with that of our own city. In the absence of any facts bearing on this question, it is little wonder that the public as a body are somewhat apathetic with regard to it. We are accustomed to hear of Glasgow, Sheffield, Manchester, Wigan, and other towns being dubbed centres of smoke and dirt. We have no proof that these are in reality worse than their neighbours, because it does not appear to have been considered essential to make any experimental research.

Now it does seem to me that a problem of the magnitude and importance of the smoke problem, and one which affects in such a material manner the comfort, cleanliness, and health conditions of all who must dwell in cities, ought to be treated on the most scientific lines; that each town of any pretensions should have connected with its sanitary department some means whereby the amount of dust and smuts in its air could be gauged and analysed.

We would then be able to ascertain how the air of each town compared with that of all the others; and, as one town seeks to emulate the other in the matter of a lessening death-rate, so the periodical publication of town smut-rates would, in like manner, arouse a healthy stimulus in the matter of a clean atmosphere.

I was led into this train of thought by a lecture which was delivered last winter by our Sanitary Inspector, in which he showed how various parts of Glasgow stood with reference to atmospheric pollution. I requested him to be good enough to extend these observations in the city, so that I might be in a position, from the presentment of actual facts, to illustrate to you to-day the bearing of my remarks. Thereupon the city was divided into 25 districts for purposes of experiment. As a matter of fact, the electoral divisions or wards were selected as suitable centres, and in each ward a wooden water-tight gauge, 12 inches square, was placed on the roofs of buildings at a height of between 30 and 40 feet from the ground-level. They were placed in position on the 1st of March and left for 100 days, or until the 8th of June. They were then carefully removed and placed in the hands of the Corporation Chemist for analysis. The first four columns of the tabular diagram (page 679) show you the

result. You will observe the analyst has divided the solid constituents found in each box or gauge into three parts, the mineral or indestructible matter, the oily or greasy matter, and the organic or volatile matter. The second and third columns exhibit the substances which may be said to be derived almost purely from smoke emissions, while the first column may contain a certain proportion of minute mineral gritty or dusty particles, which are cast into the air of any town by the operation of industrial processes, or lifted by the winds from road surfaces.

It will be noted that Wards 10 and 13 are not represented in the table, as it was found in both cases that an accident had occurred to the gauges, but I think that the results shown are amply sufficient to warrant us in concluding that they indicate a correct average for this city.

It is not my purpose to weary you by any analysis of the differences of one ward from another. Speaking generally, they show, notwithstanding singular divergences here and there, that the heavier smut-rates are found in our more industrial and crowded areas; while the outlying and more sparsely populated districts show less air pollution. The great purpose which they serve is to illustrate what I mean by a city smut-rate, for a specified period, during the year.

Here we find that during 100 days in spring the deposit of dust and smuts from the air of Glasgow averages 109 grains upon each square foot. 63½ grains of this are mineral, or found to be unburnable; 3½ grains are composed of grease, or the oily extract obtained from the soot; and 42 grains are the smuts or other organic substances, easily consumed by fire.

The second row of columns exhibits, in a corresponding manner, the deductions arrived at from the first row. It has been assumed in each case that, if a certain number of grains have fallen on one square foot within a particular ward in 100 days, a proportionate amount has fallen on each acre of that ward during 365 days. On this fairly legitimate assumption, we arrive at the conclusion that the smut-rate of Glasgow is 22·119 hundredweights on each acre per annum; further that 13 cwts. of this is mineral matter, ·722 cwts. grease or oily matter, and 8½ cwts. is volatile or organic matter.

If these observations had been conducted over the whole period of a year (as for strictly comparative purposes with other cities they ought to be), we should be in a position to see at a glance how our air stands, as regards dust pollution, in comparison with that of the chief towns of the United Kingdom. It is regrettable that no information of this kind seems to be obtainable from them, and it is to be hoped that in the near future

each important sanitary authority will make an effort to obtain this very important information relative to the atmosphere of the district.

Meantime, Glasgow has a standard to go upon. As years proceed, and the existing law against smoke emissions continues to be administered, we shall be in a position to compare each future year with this one, and so be able, in a scientific way, to mark progress. If no progress is observable, it is a fair inference that the law against smoke, or its administration, is defective. I say this because I have become quite convinced that mechanical science, in its application to the proper combustion of fuel, whether the fuel be coal or the gas obtained from it, is now quite capable of relieving us from this nuisance. Further, that this much-needed relief may be obtained in a manner quite consistent with economy, so far as steam production is concerned. In my own works, I have been able to prove this, as, whereas in former years I admit having contributed my share to the air pollution of the city, I now rejoice in a clear chimney-top from morning till night. I do not intend to reiterate, what must be well known to most of you, all the ways and means which may be adopted to this end. All manufacturers know that steam-boiler furnaces continue to issue volumes of smoke from various causes. What I contend for, is that there is no cause of smoke to-day which is undiscoverable, and is not removable, if suitable means are employed.

I would at this point, however, say this for manufacturers (many of whom have willingly adopted the best structural means they know of), that, notwithstanding their expenditures and endeavours, these have been rendered abortive by the absolute carelessness of their firemen. I have consulted our Sanitary Inspector, who has charge of the matter here, and he informs me that a very large proportion of our smoke emissions is alone due to this cause.

I remember, at a great meeting of gentlemen, deeply interested in smoke abatement, which was held in the city many years ago, the then Lord Provost, Dr. John Ure, told us how he had permanently cured the evil in his own case by adding one shilling per week to his fireman's wages, on the explicit understanding that, if his firm was in future fined for smoke emissions he (the fireman) would pay the fine. The firm was never again summoned to the Court. The cure was complete. I am not sure, however, that firemen should be bribed to do their duty. It appears to me that the penalty should, in these cases, fall upon the actual transgressor. This is the case under the Alkali Acts, in which there is a provision that where the manufacturer can satisfy the inspector that his plant and appliances are complete, and free from the flaws which tend to

permit the escape of noxious fumes into the atmosphere, the workman found responsible may be summoned to the Court and answer personally for his ignorance or carelessness. So it should be in regard to smoke pollution. Given a steam boiler or boilers, with flues and chimney, and ratio of consumption of coal compatible with a smokeless furnace, the prosecuting authority should be empowered to proceed against the fireman, or otherwise show to the satisfaction of the Court that, on account of some defect inherent in the plant, or the fuel, or because of overpressing for steam, the manufacturer was responsible. The odium of having to appear in the Court and being convicted of an offence should, in all fairness, be laid on the offending party.

I will now in a closing word refer to the domestic fire, which is by no means free from blame. I need not enter upon any argument as to the causes of our household smoke. We all know it well. The diagnosis of the disease is, as in many medical cases, much simpler than advising as to the cure.

Sir William Ramsay in 1896 proposed to demolish domestic smoke by the extensive use of coke. He alluded to the fact that at each of our large corporation gas works an enormous amount of coke or gas breeze was made, and referred to the difficulty then of disposing of the coke, on account of its weak power of ignition. Since that time, however, we know that a great demand has arisen for this material, and that a very ready sale is obtained for it all over the city. I do not wish you to infer from that, that the citizens of Glasgow could not, if they desired to do so, utilise this fuel in their grates and stoves as they do in Paris and other French cities. Those who have had the pleasant experience of residence in the French capital know how clear and brilliant the air of that city is, compared with the atmospheres of many of our cities, and that this is entirely due, as was pointed out by Sir William Ramsay eight years ago, to the nature of the fuel burned. This, he admitted, was the only plan, so far as he could see, which would lead us towards a bright and clean city, "without trampling more than need be on those very sensitive excrescences, the corns of sentiment."

On the other hand, Mr. Fletcher appeared to think that the use of closed stoves on the American system would be preferable. He spoke of his experience of the hot-air stove in the basement of his house giving a genial and general warmth throughout the whole of it, while gas fires in some of the rooms supplemented the stove, as might be required. All the cooking, he said, was done by gas, adding: "As there was a copious supply of warm air sent into the house, all draughts were outwards, so that fogs

and dust from the outside were excluded. Such an arrangement as this is an effective cure for domestic smoke, and could it be generally adopted a great change for the better would be made in the atmosphere of our towns."

I do not know that at this present day we have advanced much beyond those two views. It is true that the manufacture of gas and its utilisation, both in connection with cooking and the heating of apartments, has made very great strides during the last seven or eight years; and my opinion is that for cooking purposes alone, gas is able to hold its own, from the economic point of view, with the coal fire. It has also the further advantage of being much cleaner, and I am not aware that the fumes which arise from the gas in the process of cooking have any deleterious effect whatever upon the meat or food subjected to their influences.

With reference to the heating of our houses, or the apartments therein, during the winter season, the problem is somewhat more difficult. The British citizen likes to see his roaring fire, and takes a calm delight in pokering it up every now and again, in order to make it brighter and cheerier; and, as Mr. Fletcher stated at the end of his paper, he would be "a bold man who would try to persuade a Briton to give up his open fire."

Still, the progress of sanitary and mechanical sciences, combined with the growing necessities of public health, and the keener appreciation we have, as time proceeds, of the hurtfulness of many things which aforetime were looked upon as necessary evils, leads me to the conclusion that the period may not be far distant when the gas-fire shall supersede the burning of raw coal in our grates. Its superior cleanliness alone should, one would imagine, attract every tidy housewife, were its cost so reduced that, when burning constantly for 10 or 12 hours, it would, all things considered, compare favourably with the coal fire.

I understand that its production on the Mond system has made such rapid strides that it is now coming into use in some of our large iron and steel works, where it is intended to utilise it not only for the purpose of raising steam, but also for the purpose of heating and re-heating the steel in the furnaces. The value of the by-products, viz., the ammonia and the tar separated in the process, is so great as to admit of a great reduction in the cost of the gas itself. This being the case, it seems that in all cities only one consideration stands in the way of its immediate, adoption by the citizens in connection both with cooking and heating, viz., the distribution of it. It is obvious that the cost of laying new large gas mains for producing gas throughout a city would be quite prohibitive, but it appears that the resources of gas engineers are by no means exhausted,

and recently we have been learning that, by the issue of coal gas in small pipes, under a pressure of 60 or 70 lbs. on the square inch, the cost of distribution will not only be very materially reduced, but the citizens may be able to obtain, at a comparatively low rate, a sufficient supply of gaseous fuel at a reduced pressure for all domestic purposes.

Possibly during the discussion which is to follow there may be gentlemen here who can throw some technical light upon this part of the great problem of smoke production and its abatement.

In 1896 my friend Sir James Bell, then Lord Provost of the City, at the close of his Presidential Address to the Congress, said that in Glasgow the impurity of the river and of the air was the "heaviest indictment Dr. Russell had to lay against it." To-day the former of these impurities has, at great labour and cost, been so far successfully dealt with, and we have now entered upon the last phase of that gigantic undertaking, which in a few more years will finally remove a long-standing reproach from the Clyde. The trend of mechanical and chemical science, backed up by public opinion, is now in the direction of a determined attack against the other impurity. Probably it is the greater of the two, as certainly it is the more difficult to be dealt with.

It is my ardent hope that the outcome of the deliberations of this Conference upon it will do much to hasten on the time when, with a purified air, as well as a purified river, our city may proceed to attack the minor evils which still hinder her advancement towards that ideal of all sanitarians, Hygeia, the City of Health.

I should also say that we as a Corporation in Glasgow are doing very much in a quiet way to reduce smoke production and the smoke nuisance. We have some notable citizens who are co-operating with the city authorities. For instance, the Beardmore forges, out in the east end of the city, which used to be a menace and a disgrace, environed as they were by an ever-present pall of dense black smoke, display an improvement. The public spirited proprietor of those works has, for one-half of the works, already erected a gas installation for the making of electricity to provide the motive power. The other half of the works will be similarly treated within a year, and the district in which smoke was produced equal to the production by many towns of 20,000 inhabitants, will soon have a clear and pure atmosphere. But he does not do it from a solely philanthropic idea, nor altogether from the point of view of the good citizen. These qualities may be present, but that proprietor does it because it is economically sound, and because he will make money out of it. I believe in that direction a great deal more can be done.

Now, I do not like to preach without endeavouring to practice what I preach, and in connection with my own works during the last six months we have been investigating with the Thompson patent furnaces that have given results that are absolutely astonishing. One of our boilers being overpowered, was continuously emitting volumes of black smoke that made me ashamed of my calling and ashamed of my citizenship. We had tried several methods, which did not prove effective, but by putting in Thompson's furnaces we have absolutely annihilated the smoke. What is far better, I have had the statistics taken out for some time, and I may tell you that in the economical aspect, in addition to the elimination of the smoke, the installation has resulted in an increased output of 50 per cent. and an economy of fuel of 17 per cent. per pound of water evaporated. Now, that patent furnace has a future, I have no doubt, along with many others, but I do contend that what we need most is a thorough awakening of the public conscience to the evil of black smoke. We know well how the pioneers of sanitation have had to fight an uphill battle. They had to fight in a way of which we know nothing to-day. In their days the country was absolutely indifferent to the call for reform, but as men with souls, men who would have hereafter to give an account, they laboured on in the face of difficulty and in the face of opposition, and they had to do this without appreciation or even recognition. What is the result to-day? Bridge over a period of forty years, and you see the sanitary condition of the country at large raised from a slough of despair and set upon a hill. It will be the same in the end with the smoke nuisance. Progress will necessarily be slow, there will be failures attending our efforts, but I hope that from every failure we shall rise to fresh effort in a new battle. I trust the day is not far distant when our otherwise beautiful city (for Glasgow is a beautiful and stately city) will be able to eliminate smoke and fog and grime, and that it will with greater justification be described, alike in commercial progress, alike in endeavouring to bear its part worthily among the civic institution, as the Second City of the Empire.

Samples of Atmospheric Dust, taken from 1st March till 8th June, 1904.

Total Quantity of Suspended Solids existing in Samples.

Description of Sample. (100 Days.)	Expressed in Grains per square foot.				Expressed in Cwts. per Acre per Annum.			
	Mineral.	Ether-Soluble Solids—Grease.	Volatile or Organic.	Total.	Mineral.	Ether-Soluble Solids—Grease.	Volatile or Organic.	Total.
Ward 1. 85, Preston Street	104·36	4·18	52·57	161·11	21·164	·848	10·661	32·673
,, 2. Moncur Medical Mission	76·65	2·87	69·16	148·68	15·544	·582	14·026	30·152
,, 3. Crownpoint Road Chapel House	101·24	2·27	68·77	172·28	20·531	·460	13·947	34·938
,, 4. Corner of Moore Street and Duke Street ..	16·18	4·90	30·23	51·31	3·281	·994	6·130	10·405
,, 5. Circus Drive, Dennistoun	57·80	3·78	16·62	78·20	11·722	·766	3·370	15·858
,, 6. St. Rollox Public School	48·99	3·73	26·27	78·99	9·935	·756	5·328	16·019
,, 7. Springburn Public Halls	40·78	2·43	33·66	76·87	8·270	·493	6·826	15·589
,, 8. 87, Parson Street	46·72	6·16	48·65	101·53	9·475	1·249	9·866	20·590
,, 9. Fruit Bazaar	33·95	2·95	20·15	57·05	6·885	·598	4·086	11·569
,, 11. 216, West George Street	44·80	3·27	31·93	80·00	9·086	·663	6·475	16·224
,, 12. 17, Mains Street, off Argyle Street	93·11	4·62	75·37	173·10	18·882	·937	15·285	35·104
,, 14. Wylie & Lochhead's Premises, Kent Road ..	37·74	3·57	24·93	66·04	7·653	·683	5·056	13·392
,, 15. Woodlands Rood	42·62	2·95	24·59	70·16	8·643	·598	4·987	14·228
,, 16. Training College, New City Road	106·91	2·79	67·75	177·45	21·681	·566	13·739	35·986
,, 17. 917, Garscube Road	54·87	3·35	34·83	93·05	11·128	·679	7·063	18·870
,, 18. South York Street	69·52	4·70	40·33	114·55	14·098	·953	8·179	23·230
,, 19. Abbotsford School	36·45	3·19	19·08	58·72	7·392	·647	3·869	11·908
,, 20. Pollok Street U. F. Church	94·18	5·00	36·13	135·31	19·100	1·014	7·327	27·441
,, 21. Calder Street Public School	89·40	2·85	32·76	125·01	18·130	·578	6·644	25·352
,, 22. Langside School	95·59	2·45	28·69	126·73	19·385	·497	5·818	25·700
,, 23. Maxwell Park Public Hall	47·42	2·90	35·00	85·32	9·617	·588	7·098	17·303
,, 24. Hillhead Burgh Halls	44·34	3·69	15·59	63·62	8·992	·748	3·162	12·902
,, 25. Maryhill Burgh Buildings	79·74	3·40	130·41	213·55	16·171	·689	26·447	43·307
Average for City	63·62	3·56	41·89	109·07	12·902	·722	8·495	22·119

THE MUNICIPALITY AND THE PLUMBER.

By ROBERT CRAWFORD, LL.D., D.L., J.P.

THE connection between the municipality and the trades must of necessity be an intimate one, if civic progress and well-being are to be maintained. In the Glasgow municipality this intimacy has, for many generations, been officially recognised. The Trades House, which may be said to be the embodiment of all our trade incorporations, is represented in our council chamber (without popular election) in the person of its deacon convener, who is entitled, in virtue of his office, to all the rights and privileges appertaining to a duly-elected representative. In addition we have in this city a statutory court for the consideration of all matters having to do with buildings, both as to their erection and reconstruction. Here, also, the trades are strongly represented under the name of "Liners," who, being part of the Dean of Guild's Court, assist in the adjudication of all plans presented before it, the Dean being also an ex-officio member of the town council. By the assistance of these "liners" the building construction of the city has for many years been regulated under an Act of Parliament, called "The Building Regulation Act," and the By-laws made in virtue thereof.

But, in a broader sense, the municipality and the city trades must have a close and cordial affinity—a constant interdependence—if advancement is to be made along progressive and hygienic lines. The broad basis on which the strong and staple superstructure of a healthy city must rest, is that of prosperous trade, in the hands of energetic and conscientious tradesmen. The conservation of its trade in such hands, it is every municipality's bounden duty to encourage alike for the sake of the city and its tradesmen.

The professions are by law enabled to organise themselves into close corporations, and by strict examination can exclude those whom they may consider unfit. The public are thus protected from those who, otherwise, might palm themselves off as ministers, lawyers, or doctors. The so-called "quack" may preach, counsel, or attempt to cure, but the citizen

knows he is a "quack," and needs no further protection than that knowledge. In these professions the various universities and colleges take the place of the municipality, and guarantee the validity of their examinations, and the fitness of those who pass them. Let us consider how the public stand in relation to a tradesman in this respect. In presenting you with this consideration, I have selected the trade of the plumber for two reasons. Firstly, he is pre-eminently the man whose work is difficult to follow or to understand; hidden work, in fact, which, while it may be termed "Caviare to the general," mostly and most immediately affects the public health; secondly, he is the only tradesman who, in recent times, has made persistent efforts to organise himself with a view to legislative recognition, and to so secure his trade from the influx of incompetence that it may become a protection and security, instead of a menace to the public.

The plumber's work stands in relation to the house very much as the arterial and veinous system stands in relation to our own bodies. A single weak point in the soil-pipe or its ventilating extensions, or in the hidden drains beneath the dwelling, may be sufficient to deprive any of the inmates of his health, or it may be even of his life. In saying this I am not putting the case too strongly.

In the old days, fifteen or twenty years ago, a holed pipe, or a leaking joint, or a defective connection or extension, which permitted the entrance of sewer or drain gases, was considered the direct cause of typhoid fever or diphtheria. Modern opinion has modified this belief somewhat. It is now considered that these diseases can only be conveyed by drain gases if the specific germ of either is able to gain admission to the house. But it is still generally admitted that any leakage of this contaminated air into a dwelling, office, or workplace is so lowering to the system as to make it peculiarly susceptible to contract disease, and that it directly tends to a poisoning of the blood.

Here we see the mighty power for evil which lies in the hands of the plumber. A quack doctor may, by incompetence, kill his patient quickly, but the unskilful or incompetent plumber may so do his work as to poison slowly and imperceptibly a whole family. The public are protected against the one, but still are left to the mercy of the other. It may be urged, of course, that the municipality stands protectively between the plumber and his possible victims. I admit that before any new building or house can be occupied, an officer of the municipality—the sanitary inspector—must examine and test the drains and pipes before the house is permitted to be occupied; but, even if it be admitted that, on all such occasions, this

ramification of pipes can be so tested as to ensure absolutely that no risk exists (an admission which suggests the improbable), there still remains the vast mass of drainage appliances, which is not new and which plumbers continually are engaged upon, patching and repairing, unknown to the municipality or its officers. The amount of work on new buildings must be small compared with that done by the plumbers of any large city in the way of repair or reconstruction.

I find from the sanitary inspectors' annual report for last year that the drainage of 1,526 old properties in Glasgow was tested by the smoke-test in that year alone, and out of that number only 435 were found in order. This is not quite 28 per cent. of the whole. It is not at all a satisfactory record, and suggests that a large amount of defective plumbing-work still lies undiscovered in city property and in property everywhere. I suggest that there is much of the plumbers' work going on every day over which there is no municipal supervision whatever.

But, even on the assumption that the municipality could find it possible to watch and follow the plumber in the public interest, I would ask is this the best way to safeguard the public from careless scamping or sheer incompetence on his part? Should the ratepayers be asked for all time to keep up an army of inspectors to ensure themselves against the risk of disease traceable to the work of ignorant and incompetent men?

Is it not, on the face of it, much more reasonable to seek for a condition of this trade, so closely connected with the general health, which will, by examination and registration, prevent it from being occupied or invaded by the ignorant and the unworthy.

This leads us naturally to my second point, viz.: to consider the efforts which the plumbers have put forth, in their Registration Bill, to secure legislative recognition for their trade, and the nature of the opposition which has, for so many years, been successful in opposing it in the House of Commons.

About sixteen years ago, when I happened to occupy the position here of chairman of the health committee, the Worshipful Company of the Plumbers' Guild in London sent two of their number on a tour through the principal municipalities of the kingdom. Their mission was to explain the anxiety of the Worshipful Company regarding the condition and position of the plumbing trade throughout the country, and the need that seemed to exist to so improve the *personnel* of its members, both as to education and responsibility, that the public might have a reasonable confidence and guarantee that the all-important work done by this class of tradesmen would be of the highest order. They appealed to many corpora-

tions to assist them in this movement. They appealed very successfully. Glasgow and the West of Scotland, along with other populous centres, at once saw the advantages to the public health which would flow from a legalised registration of men proved to be fit, after adequate study and examination, to pursue the calling of the plumber.

The municipalities rose to the occasion, and along with the masters and operatives in the plumbing trade proceeded to the establishment of district councils all over the country, assisted to draw up regulations and establish theoretical and practical classes, and, generally, to organise, under the auspices and lead of the Worshipful Company, what has come to be recognised as the "Plumbers' Registration Movement." Throughout the length and breadth of the land the movement spread and flourished, and culminated years ago in a Bill, which was drawn up, duly considered, and finally adjusted at a great Pan Conference of the combined district councils. In due time, after much expenditure of time and money, the Bill was brought into the House of Commons by Mr. Lee Knowles, M.P. The Bill was supported by the English Local Government Board, and by their help passed the House of Lords in 1902. Since then the congestion of parliamentary business has rendered further progress impossible, but it is to be hoped that a time may soon come when such legislation will be taken up as a Government measure in the public interest. The only powers sought are those necessary for the public protection: first, to prevent persons falsely describing themselves as registered plumbers, and second, to strike off the roll those persons guilty of offences in their capacity of plumbers. There are now 12,000 plumbers on the registration list. The Plumbers' Company have spent over £35,000 in organising this most important and highly beneficial movement. Classes for the education of apprenticed plumbers are now in operation in many places, very notably in Glasgow, in our Technical College, under the approval of the Scotch Education Department, and in many places in England, with the approval of the Department of Education for England.

Quite recently the water authorities of Great Britain and Ireland, having the approval of the Local Government Board, have asked the Plumbers' Company to bring within the scope of the movement the work of the plumber, so far as concerns the introduction of water, with a view to the prevention of waste and the adoption of uniform regulations, and the standardisation of fittings.

Masters, operatives, municipalities, county councils, educational authorities, local government boards, all cordially approve of registration, but owing to the feebleness of our parliamentary machine the necessary

legislation for the necessary regulating and controlling of the machinery is year after year delayed.

Meanwhile the burgh and county and water authorities could render much help to this reform by definitely deciding to give preference, so far as lay in their power, to the employment of registered plumbers as against plumbers not registered. This visible token of confidence and active support on the part of those responsible for the public welfare in this department would be not only an inducement to all those engaged in the trade to join the movement, but would be an additional source of strength to those who are actively engaged in this sanitary reform crusade, in their efforts to press upon the House of Commons and the Government the great public advantage which would result from the passing of the Bill for the Registration of Qualified Plumbers.

Plumbers' Company.

Edward III. *Ancient Ordinance.*

"That no-one shall touch the trade of a plumber except by assent "of the best and most skilled men in the trade testifying that he knows "how well and lawfully to work, and to do his work, so that the trade may "not be scandalised or the commonalty damaged and deceived by folks who "do not know their trade."

Jurisdiction of the Plumbers' Company: the City of London and seven miles. Instituted 1365.

Edward VII. *Modern Organisation.*

The National Registration of Plumbers, combined with technical education for apprentices and examinations in craftsmanship, is carried out by the Plumbers' Company, acting through local councils in the chief cities of the kingdom.

Jurisdiction: Great Britain and Ireland.

Dr. Crawford then proposed "That it is necessary to the effective administration of the Public Health and Water Acts that the relative authorities be recommended and empowered to require that the competency of the plumbers employed to execute or inspect plumbers' work, under the regulations of those authorities, shall be certified by the Plumbers' Company under conditions appertaining to the National Registration of Plumbers, or by such other body as may be set up by statute, or be approved by the Local Government Board."

Alderman Hind (Stockton-on-Tees) said that he would second the motion because his experience in municipal and sanitary life enabled him to endorse the remarks of Dr. Crawford.

The recommendation was carried.

The following took part in the discussion:—Mr. Robinson (Durham), Councillor Smith (Birmingham), Mr. J. Young (Battersea), Mr. Thompson (Birmingham), and The President.

THE HOUSING PROBLEM AND THE MUNICIPALITY.

By SIR SAMUEL CHISHOLM, Bart., LL.D.

I HAVE not been able to find among the topics set down in the official programme for discussion at this Congress of The Sanitary Institute, the subject on which I have been asked to speak, namely, the Housing Problem and the Municipality: and yet the relevancy of the subject is not difficult to establish. If The Sanitary Institute has no reference to the homes of the people, and to the influence which local authorities can bring to bear upon the condition and character of these houses, then it seems to me it has little justification for its existence. For the whole science of Sanitation, in the widest sense for which its most enthusiastic advocate can contend, may be truly said to centre in the home. It is to make the homes of our people sweet and bright that this science has been founded, and that its study has been and is being prosecuted. Robert Burns was right when he said that

> "To mak' a happy fireside clime
> For weans and wife
> Is the true pathos an' sublime
> O' human life."

But a "happy fireside clime" can scarcely be imagined in connection with an unclean, unwholesome, dark, and filthy dwelling. And so, whether we think of the poet's ideal, or of that of the sanitarian, we are face to face with the housing problem.

Now, you must not on the present occasion ask me to prove that there is a housing problem. You must permit me to take that for granted. Whatever the explanation of the facts may be, on whosesoever shoulders the blame may lie, the truth is indisputable that in all our great cities, not to speak of our towns and villages, there are thousands of occupied dwellings, the situation, character, and condition of which render them absolutely unfit for human habitation. What with one-room houses, backlands, overcrowding; what with drunkenness, dirt, poverty; and what with the frequent combination of all these conditions alike of the house

and of the householder in one, it needs no brilliant imagination to picture the character of the housing problem with which we are confronted.

But my purpose to-day is to point out the responsibilities that rest on the municipality in this connection, and, if I have time, the range and scope of the action which lies within the sphere of the municipality's duty.

Is it still open to question whether or not the municipality has any responsibility in connection with the housing of the people? Is it still contended that the almighty law of supply and demand may be safely left to work out its own automatic and inexorable result? Is it still asked, Why should the municipality interfere with the free play of this great and eternal principle? If so, then the answer is not far to seek. Because, if the so-called law of supply and demand were left to its own untrammelled action, that is to say, if poor, weak, selfish, avaricious human nature were left to follow its own bent, unhampered by an authority that represents and stands for the rights of the weak and helpless, society would quickly become a chaos and fall back into absolute savagery. In this very sphere of housing, if proprietors had been at liberty to offer for occupancy whatever houses they chose, without respect to situation, size, equipment, surroundings, and simply to fall back on the dictum, "If the tenant does not wish to take the house, he can let it alone," we all know that, unsatisfactory as the state of things is at present, it would have been infinitely worse. For, notwithstanding the large number of high-principled proprietors who would scorn to offer for habitation anything they knew to be unfit for such a purpose, there are too many who would gladly take advantage of the liberty allowed them, and continue to let and take rents for houses that had ceased to be worthy of any human tenant. It is to the local authority we owe it, and not to the untrammelled law of supply and demand, that the worst and most disreputable of our slums have disappeared and are disappearing. And were the local authority to relinquish its grip to-morrow, and leave the whole question of the condition and character of our dwellings to be settled, as between landlord and tenant, by themselves, what with need or greed on the one hand and poverty or vice on the other, the homes of the poor would, in a thousand cases, quickly become the reeking abodes of filth, of pestilence, and of death.

The most precious charge committed to the care of our municipal rulers is the life and health, and for that purpose, and so far as they can be reached, the home conditions of our people. It is all very well to provide tramways and telephones; it is all very well to provide picture galleries and museums; it is all very well to have, as Glasgow has, Corporation golf courses and bowling greens. I am the last man to disparage any or

all of these. Yet who can deny that these do at the best touch but the surface of the people's life; it is the home influences that make or mar, alike physically and morally. It seems to me, therefore, that the most important question which an enlightened municipality can ask itself is, to what extent can we, by the legitimate exercise of the powers we possess, or by the acquiring of new powers that are congruous to our sphere of action, to what extent can we make sure that the homes of our people shall be fit abodes for the generation that is, and fit nursing ground for the generations to come?

This responsibility of municipal authorities becomes all the more weighty when it is borne in mind that the condition of things we all deplore and seek to amend arises largely from the neglect or ignorance of their predecessors. The rush of the population to our great industrial and commercial centres, for which the last three-quarters of a century have been distinguished, found our rulers not only altogether unprepared, but positively unwilling to recognize that they had any duty whatever to discharge in connection with it. And so, under their very eyes, and without any protest, much less any vigorous effort to prevent it, backlands were erected, courts and greens that had been open lungs and health-giving breathing spaces were bit by bit built up, till almost every available inch held its quota of human beings crammed and jammed as if all they required for life and well-being was simply room to stand. To make things worse, the big house, the home of some comfortable burgher, which used to contain a single family for whose use there had been provided the airy court and spacious green behind, is, now that court and green swarm with their crowded residents, made down, partitioned off, cut up, and divided until, instead of one family occupying four flats, there are perhaps four families in one flat, with no breathing space behind at all. Had municipalities, at the time when this deteriorating transformation was taking place, been alive to the results of the process, and sought instantly new powers to deal with the new state of matters that was growing up, the deplorable condition of things which all our great cities exhibit might have been largely obviated or lessened.

The neglect of municipalities fifty years ago to check or control the process or processes which were producing the slums of to-day may not have been culpable neglect. It was, municipally and socially, an easy-going time, and the new sphere of thought and effort which has been opened up in connection with our great cities, was practically undreamt of. But the very fact that it was so largely through their neglect that the conditions of to-day have been brought about, ought to be felt by their

successors to be an additional reason for their girding themselves to undo the mischiefs which that neglect has occasioned.

Another circumstance which adds to the responsibility of municipal rulers for the deplorable housing conditions that prevail, is to be found in the comparative readiness with which Parliament grants powers to local authorities, where the health and well being of the people are concerned. If, as in other days, a local authority had to fight an expensive and up-hill battle with a reluctant and antagonistic government before it could take the slightest action, there might well be some excuse for hesitation to begin the strife. But by its Public Health and Housing of the Working Classes Acts, and by numerous private Acts which corporations have secured, Parliament has shown conclusively that it is prepared to encourage and assist enlightened municipalities in well-considered schemes for the improvement of the dwellings of the poor. It is no longer possible, therefore, for municipalities to throw the blame of their inaction on an unwilling legislature. If in any city there continue to exist the festering slum and the insanitary area, it will be difficult for the local authority concerned to rid itself of the responsibility for the health, the comfort, and the life that are thereby sacrificed.

What then can municipalities do? Let it be premised, they cannot do everything. Their sphere of action, however important, is limited. And there are two prerequisites before they can accomplish anything. They must, first of all, have the sympathy and support of their constituents. There must be a public opinion, a moral force, a momentum, behind them, before they can take any effective action. You can never find a progressive municipal authority, where the constituents, the ratepayers are indifferent, or perfectly satisfied with things as they are. They *may* have occasion to complain of a Parliament which has been elected for seven years acting independently of the wishes of the people, but with a representative municipality, the constituent membership of which is, or may be, so largely changed every year, such a complaint is well-nigh impossible. In any important measure which it undertakes the municipality must have behind it the moral support of the people.

And the second prerequisite which, in this housing problem, must be present before the municipality can accomplish any important result, is the co-operation, more or less hearty, of the poor, ill-housed people on whose behalf they are chiefly acting. The housing problem is essentially a complex one. It has to do with more than stone and lime and measured distances. If it is to be solved, better houses for the people must be accompanied by better-behaved people for the houses. I believe many

of the people dwelling in the slums are driven to despair by their surroundings, and yield against their better selves to a course of conduct of which, in their deepest consciousness, they disapprove. The law of their members is against the law of their mind, and brings them into captivity to the law of evil which is in their members. I believe that a vigorous and honest effort made by a municipality would be seconded and supported by an eager effort after well-doing on the part of many who at present are oppressed by the feeling that it is no use to try.

But, granted these two prerequisites, what can the municipal authorities do?

They can carry on a ceaseless crusade against insanitary dwellings, they can create and foster a public opinion which would brand it as equally shameful to supply for domestic occupancy an insanitary and defective house, as it is to supply for human consumption unsound or poisonous food. The proprietors of such houses should be known and their names published, not those of the official factors only, but of the men and women who draw the rents and live on them.

They can carry on an equally persistent crusade against dirt, not on the streets only, nor in the court or close, or stair, but in the dwelling itself, and it may be in the person too. We are not unfamiliar with the woman sanitary inspector: I would have the number of these largely increased and their status raised. The persistent visit of a woman, exhibiting not so much the authority of her office, as the wisdom, kindness, and tactfulness of her spirit, holding up higher ideals of house-keeping, but also showing how they may be realised, a system such as this, carried on with vigour and thoroughness, might not turn every unsavoury dwelling immediately into a little paradise, but it would assuredly change not a few, it would set agoing new thoughts and ambitions in the mind of many a poor and struggling woman, it would establish a blessed rivalry of a hitherto undreamt of kind, and though opposition and discouragement would undoubtedly be experienced, these would speedily diminish or disappear, or at the worst, could be disregarded, and the results in many cases would be an ample reward.

And yet again they can carry on a crusade against drink. There can be no doubt as to the disastrous part which drink plays in the dark tragedy of our people's misery and shame. It produces the vilest slums, and it peoples them with tenants befitting such abodes. It writes the deepest marks of degradation and sorrow on the features and on the characters of its votaries, and it leaves un-mothered the children who should grow up the stay and strength of the generation to come.

What can the corporation do to lessen or remove the mischief which drink produces? It can greatly help to create a public opinion in regard to drink, which, once formed, and tenaciously held, would sweep drunkenness, as it has swept other vices, right out of our midst. It can, by a vigorous expression of its opinion, and by its contribution to the action of the Licensing Court, lessen the abounding temptations to indulgence which the thoughtlessness or indifference of former generations needlessly multiplied. It can provide counter attractions on a larger scale and of a more powerful character than it has yet attempted, in order to lead the people to purer tastes and truer joys.

And then, last of all, and in fewer words than perhaps the importance of the suggestion demands, the municipality that wishes to deal earnestly with the housing problem can, when need arises, take the providing of suitable sanitary houses for the poor into its own hand, and make sure that if the people are not sanitarily housed it is not because there are no such houses for them to occupy. On this last point I must be a little more explicit. It is not one of the primary functions of a corporation to erect dwellings for the people. The normal condition of things would seem to be that the private enterprise which provides for the ordinary wants of humanity would not neglect this primal necessity, even for the poor. But when in a great and rapidly growing city like Glasgow, and, indeed, like all our great cities of to-day, we find that houses within the reach of our humblest working-people are not being erected, but that they are left to the "made down" and wholly unsatisfactory houses into which the larger dwellings of the richer citizens have been transformed, or that two families crowd and huddle in one house where a single family has barely room to live, what is a corporation to do? There is no good shutting one's eyes to the facts. It would, of course, be better if our poorer-paid labourers had higher wages. It would be better if builders could see their way to build satisfactory houses in which our poorest-paid labourers could afford to live. But a corporation can compel neither the employer nor the builder. If an employer can get abundant supply of labour at a low wage, and if a builder can make a better profit by catering for a rather higher class of tenant, the corporation cannot compel either the one or the other to alter his course of action.

It is in circumstances such as these that the need to which I have referred arises. Then, when it has arisen, the duty of the corporation is plain. Its people must live, and live as human beings ought to, and no theories, however plausible, can be allowed to stand in the way of its securing this end. The corporation can build. Parliament has recognised

this as a possibility and endowed the corporation with the needful powers. The corporation can borrow money at a cheap rate, it can dispense with the necessity of a profit after paying interest at this low rate, and therefore, with a minimum pecuniary loss to the city as a whole, or with no loss at all, it can do what a private builder has not yet done, and cannot be compelled to do, it can provide a sanitary house for those who, but for its intervention, would be compelled to live in dwellings, not only unfit for themselves, but a menace to the entire community.

It must be left to each municipality to say when the circumstances arise which render such action imperative, but when they do arise, the municipality which neglects or delays to act is providing for itself a day of retribution not far off.

Mr. Councillor Burgess (Glasgow), said they must all be of one mind with respect to the spirit that breathed through the address of Sir Samuel Chisholm. It was the true municipal spirit. They were met that day as a sanitary congress, and they wanted to know the facts, not the ideals, with respect to housing in Glasgow. The actual conditions were not of a description that would cause a feeling of pride to rise in the breast of any municipal reformer. Sir Samuel Chisholm had spoken eloquently of insanitary houses and the duty of the municipality with respect to those houses. Now, they had in Glasgow proved insanitary houses; there were 104,000 persons of the Glasgow population living in one-apartment houses. It had been demonstrated without the least doubt that the one-apartment house sacrifices life. The medical officer of health had analysed the death-rate in Glasgow for the year 1901, and there was some advantage in having a city parcelled out into one, two, three or four apartment houses, because it enabled the exact figures to be ascertained. From the analysis of the medical officer of health for Glasgow, it appeared that in the year 1901 the death-rate for the city as a whole was 20·5 per 1,000; that the death-rate in the one-apartment houses was 33 per 1,000; that the death-rate in the two-apartment houses was 23 per 1,000; that the death-rate in three-apartment houses was 13 per 1,000; and that the death-rate in four-apartment houses was 11 per 1,000. Thus in this city, under the same municipal administration, there was a state of affairs in which the unfortunate dwellers in the one-apartment houses were without the least doubt dying three times as fast as those who dwelt in houses of four apartments, though of course a portion of the death-rate might be attributed to other causes. That position had been established by their own medical officer of health, and it had further been established by another analysis made by their own local authority that wherever the one-apartment houses exist, not merely in the slums, but also in the better districts, the death-rate in those one-apartment houses as compared with the general death-rate for

the same district was as three to two, and in the suburban districts the death-rate in the one-apartment houses was as two to one. Under present circumstances they could not forbid private enterprise erecting that class of house, but so far as they, the municipality, were concerned as builders of houses, they ought not to be responsible for that class of house.

Mr. Gleaves (Great Crosby, near Liverpool) observed he had always been unable to understand why it was necessary to build these houses with only one room. A few miles from Liverpool were houses built with six rooms, and these were let at six shillings per week. Evidently what Liverpool could do Glasgow could not do. He was painfully surprised to see houses in Glasgow and Edinburgh built in flats, while outside the city were plenty of sites, nursery gardens of 30 or 40 acres in extent. The object of building these dwellings right up to the sky was not at all obvious. Apparently, the land question was at the root of the difficulty. Within a few miles of Edinburgh were being erected these flats, with one door only—the same room for bed-room, parlour, kitchen, and scullery.

Councillor Fowler Jones (York) asked in reference to the death-rate in the one-roomed houses whether, in these statistics, regard had been had to the ages of the occupants. It was a familiar fact in all cities and towns, that the aged, infirm, and crippled congregated in these small tenements, because they could afford no better; in most cases, being unable to work, their earning power was gone, and they try to live according to their means. The death-rate was usually higher among the aged. The abnormally high death-rate among the occupants of the one-room tenement was no proof of their unhealthiness. Under any circumstances the death-rate among such a population would be much higher than in a mixed population of varying ages and generally occupied. The high death-rate was no reason why single-room tenements should be insanitary or abolished. Much more likely causes were overcrowding and want of cleanliness. He felt sure the classification of the death-rate according to age would show that age had a very important bearing on the death-rates in these tenements.

Councillor R. Lambie (Lanarkshire C.C.) felt it was not the desire of anyone attending that conference to encourage the occupation by the people of one-room tenements, but at the same time he would like to have a word said on the other side. They had heard a good deal of that wonderful place called Liverpool, but judging from some of the things they had read about, in Liverpool even a good deal of improvement was required. As a man who had lived in one room, he felt it was better to live in one room and be able to pay the rent than live in a better house and not pay one's debts. There was something misleading about the statistics of the death-rate in the one-roomed houses;

they could not judge properly unless they found out how many of the occupants were permanent occupants of those small tenements; whether they had always only occupied one room. A considerable number of persons who lived in three or four rooms would migrate to the one-roomed houses, and die in them, the one-roomed houses getting all the blame for the death, and he would be very much obliged to anyone in that conference who would show them how any man with a wife and four or five of a family, with a wage of 18s. or a pound per week could pay rent for more than a one-roomed house, and live.

Alderman P. Wilson Raffan (Monmouthshire C.C.) said that the whole question of sanitation, the whole work of sanitary authorities, and the problem of improving the position of the people, came back to the one great question of how best the people could be housed. He ventured to repeat a statement which he had never yet seen contradicted, that, speaking broadly, from one third to one fourth of the people are improperly and insufficiently housed. Of course there were other evils to be dealt with, even in the case of people who had sufficient room; but, after all, he was sure Councillor Lambie would admit that, although no doubt many people had risen superior to their environment, good lives had been lived, and that many a manly man and womanly woman had lived and been trained in the one-roomed houses of Scotland, that was in spite of their surroundings and not because of their surroundings. Municipal authorities, at any rate in England and Wales, and he also hoped to some extent in Scotland, had of recent years become more and more convinced that it was utterly useless to serve notices on house-owners to abate overcrowding, and to get the people turned out of their houses, when there were no other houses to which the people could go. It was essential that the local authorities should see that there was sufficient house accommodation for the people. Reference had been made to that great bar to improvement, the land question. He believed that was the root-question. He agreed with Sir Samuel Chisholm that if they were able to deal perfectly with the land question it would be unnecessary for the municipal authorities to build houses. But presumably that was not a question for the Conference; that was a question for legislation. In many districts in Monmouthshire the Urban District Council had made contracts for building workmen's cottages. They were providing what apparently was being provided at Liverpool, six-roomed cottages; and as it was a mining district they were also providing a bath-room, so that they might set the pace for other house-owners in the locality. They proposed to let these six rooms and bath-room at 6s. a week. Of course, in Glasgow and other large cities they had the tenement-house question to face, but he hoped, in the consideration of the housing problem, they would consider the possibility of adopting the suggestion of the gentleman from Liverpool, that, instead of overcrowding the already congested part of the city, they should go out into the suburbs and acquire land, compulsorily, if necessary.

Mr. W. Urquhart (Crewe) said that in Crewe they had plenty of houses provided by private builders, but the point he wished to impress upon municipal representatives present was that local authorities should raise the standard of houses supplied by private enterprise. The authorities ought to see that these houses were properly built. Many communities still suffered from the operations of the jerry builder.

Dr. Philip Boobbyer (Nottingham) said that in Nottingham they had had the usual financial experience with condemned areas and clearance schemes. In one large scheme the original fully authenticated estimate of cost had been something under £100,000, and the actual subsequent outlay more than double this amount. Again in their re-housing schemes they had found the Local Government Board demands as to the class of house to be provided, an absolute bar to successful re-housing. The people evicted from the 2s. 6d. and 3s. 6d. houses condemned, could not in many cases afford to pay 7s. 6d., and upwards, the rentals of the new houses. The result was often the conversion of small houses near the condemned area into furnished tenements, and the last case, so far as many of the displaced population were concerned, considerably worse than the first. In Nottingham, however, tenement houses in the ordinary sense were the exception ; individual cottage-dwellings were the rule. In recent years when visiting streets and houses of more or less uniform age and pattern, he had been much struck with the varying condition of the individual houses, dependent either upon the up-keep of the houses or the habits of the people, or on both. His observation on this head had led him to advise his authority to put in operation the provisions of Section 46 of the Public Health Act of 1875, which allow the local authority to order the cleansing of a house throughout either by the landlord or tenant. At the outset a large property owner and house agent in the City, had predicted that if this section were put into operation, it would lead to the formation among house-owners and agents of a tenants black list ; that people who were incorrigibly filthy or improvident in their habits would be put upon this list ; and that ultimately such people would be unable to secure house-room, because it would be found unprofitable under the new regime to take them in as tenants. This prediction had been fulfilled to only a very small and, indeed, a salutary extent, and the new system had on the whole been most beneficial in its operation. Many hitherto negligent landlords had by it been awakened to a due sense of their responsibilties, and a large number of dirty and careless tenants had come through its agency to realize that unless they were prepared to show a proper consideration for their landlord's property, they might find themselves boycotted as tenants by all owners of decent houses in the City. Philanthropic advocates of housing reform were sometimes liable to lose sight of the fact that some of the chief obstacles to its attainment in very poor neighbourhoods, were the incorrigibly filthy and reckless habits of their denizens. He had hopes that the fear of

consequences might, in this as in other cases, exercise a reforming influence where precept and object lesson had proved of no avail.

Councillor Smith (Birmingham) said he lived about seven miles from the centre of Birmingham, and it was what might be called a rural district. They knew nothing of flats. They thought they were living in a perfect little paradise until two months ago one of his colleagues said he would endeavour to get permission from the County Council to utilize the services of a lady visitor. They had their eyes opened by the visit of the lady appointed by the County Council, and they had to take magisterial proceedings under the section which had been mentioned, and they had the satisfaction of getting a man convicted who would not keep his place clean and tidy. The people of Glasgow congratulated themselves upon their tenements or flats, but so far he was one of those who still remained to be converted.

Alderman John Imrie (South Shields) remarked that in the first place the difficulty was with the local authority itself. All the members of their local authorities were not as enthusiastic on the question of sanitation as some of them there, and that led them back to the primary question of how to get men elected who would look after these matters. Then came the difficulty that a large proportion of the population were bound to live in cheap houses. In the town which he represented there were a great number of widows who were receiving parish relief, and where were they going to house these people? There were also a large number of workmen who did not earn big wages, and could not afford to rent large houses; and in connection with this there also came in the question of furniture. If they removed a person out of a one-roomed tenement into a six-roomed cottage, such as the Liverpool representative spoke about, where was the furniture to come from? They had had great difficulty, probably, in raking up the furniture for the one-roomed house, and if they were put into a six-roomed house several of the rooms would remain unfurnished. The question was bristling with difficulties, and if some one could tell the local authorities how they could get these people to adopt cleaner methods and habits, and live better lives, the difficulty would be pretty well solved.

Dr. Simpson (Waterloo, Liverpool) observed that a great deal had been said in the discussion about the 6s. 6d. house, with its six rooms. He lived within a mile of the place, and knowing what had been done could confirm the statement. He believed they could do very much as local governing bodies to ameliorate the condition of the working classes by providing tenements such as described by the gentleman from Liverpool. In the little township from which he came they had done similar work. They had erected cottages with five rooms and bath, which could be let for 6s. a week. The cost of the land was a shilling a square yard, and the six-roomed cottages cost £150 to build. He was con-

fident that if the surroundings of the poor were improved they would learn to appreciate the altered conditions, but in his opinion they would never be taught, so long as they were surrounded by everything which was too degrading and demoralising, to regard cleanliness as next to godliness, and to seek to uplift their social position. He had lately visited Bourneville, near Birmingham, and was greatly struck with the wonderful influence of the environment there. He was personally acquainted with Mr. Lever, who had built Port Sunlight, and there every little house had its front and back garden, its bath and its five rooms. The little town had in its centre a lecture hall, gymnasium, dining hall, and every convenience that the poor man could desire, and Mr. Lever said that he found the morals of his people to rise according as he provided them with what was rational and essential for a reasonable life. He thought those were very important facts.

Mrs. Mason (Glasgow) said it was possibly quite true nowadays that if they alleviated the surroundings of the working classes, the working classes would alleviate themselves, but she could only speak from what her father did. She was speaking of forty-five years ago—she thought it was in 1859—when her father put baths in the houses he built. He did not feel that he wanted to give the baths for nothing, so he charged a penny per bath, and kept a man on the premises to look after them. He also put in washing-houses, which the women could use for washing. That was not a very common thing in those days in Edinburgh, even in much better houses than she was referring to, and even now it was not everything which could be desired in that sort of way. But perhaps they would hardly believe it when she told them the baths were scarcely ever used, and the washhouses were almost as little used. The women preferred washing in their own houses. He built a library and gave them books to read, and supplied them with weekly papers, but the books were all torn. The houses contained two rooms and a kitchen, and the rents ranged from £12 to £16 a year. But the tenants broke up all the wood in the houses for firewood. Doubtless Dr. Simpson spoke with authority, but that was her experience. A six-roomed house was utopian; it was lovely if they could carry it out. The trend of the meeting had been to run down municipalities, but she did not think they had been quite fair with them.

Mrs. Greenwood (London) said she was working as a sanitary inspector in the Borough of Finsbury, which had a larger number of tenement houses than any other Metropolitan Borough, and it might be interesting to the meeting to hear that they had large blocks of tenement houses which were extremely well kept; where the things were not broken up, and where the washhouses were used continuallly. They had all kinds of tenement houses in Finsbury, and she did not say they were all equally well kept. Among others the Guinness Trust had put up a large block of buildings, and whenever there was a careful superin-

tendent and carefully drawn up rules they found that the working people were very anxious to get into the houses, and that there was always a list of applicants which would fill them over and over again. The working women preferred to have washhouses in their own set of rooms, whether 2, 3 or 4 rooms, to having common wash-houses on landings where they all worked together. She felt herself that there were advantages in the separate washhouses, because in the case of an outbreak of infectious disease it was better that the linen should be washed in the flat itself than that it should be mixed up with other people's things. In another set of buildings there were baths in the washhouses. She asked a woman if they were generally used, and was told they were not, and the reason was that only cold water was laid on. If they wanted people to bathe baths must be provided, with hot water fittings.

MISS E. M. EVANS (Nottingham) thought the crux of the matter lay in the supervision of the tenements by the municipalities. There must be either lady rent collectors, or men with women's minds on the subject, or lady health visitors who could teach the poor something about personal cleanliness and house cleanliness. The rent collectors should hold in their hands certain privileges which people could get by being good and clean tenants and which dirty tenants would never have, and they would thus be able to get their municipal dwellings into a decent and clean condition. They wanted to begin at the very bottom. It was no good building good houses—in fact, little palaces—if they did not teach the poor that came there to love cleanliness. The poor should be shewn how miserable and uncomfortable dirt was, for if they once made them feel the discomfort of dirt they would find the people want to alleviate it themselves.

MR. COOPER (Aberdeen) said that he would not like it to go out from the Conference, nor like the Conference to come to the conclusion, that all they had to do was to point out that there were certain people who lived in certain streets who did not keep themselves clean. That was usually the gist of the speeches they had heard. He had no sympathy with a municipality which would not take the matter up. The municipal authorities had powers under the Act, and if they could not compel private enterprise to provide proper houses for the thousands of people who lived in their slums, then the local authorities must do it themselves. It was not a question of whether or not they could do it at a certain figure, but the question was that they must maintain a high standard of public health. Of course they had to do it as economically as possible, but it was not for them to consider, in the first place, as to what was going to be the cost. If they were not able to wipe out the cost from the rents, then they must draw upon the rates to pay for it. Were they quite sure they were not drawing upon the rates for the slum property? Would not the money be better applied for the purchase of houses that would last longer than the life of the present genera-

tion, rather than for keeping the people clean? In Scotland they were bound to build houses of a certain class before they were able to pass their Dean of Guild Courts, and if the rents they got were not sufficient to wipe out the cost of these houses, he maintained they were perfectly justified in drawing upon the rates.

The President (Councillor W. F. Anderson) said he thought they had mixed up two things in the discussion, and had tried to look for the remedy from either of two sources, when in his humble opinion the remedy was to be found from both sources. To his mind it was the greatest nonsense to say that because it was a one-roomed house people died. It was the condition of the one room, the density of the people in that one room, and the miserable condition in which it was kept, that caused the tremendously high death-rate. He felt that private enterprise was sufficiently able to deal with the housing problem of those people who command a moderately fair wage in the labour market, but he held it most clearly that poor people who were compelled even to buy second-hand clothes had no right to be compelled to take second-hand houses, and that was all they got at the present moment. They knew they could not put tenements on ground which cost more than 15s. a yard, but the ground could not be stolen and carted away, but would be there for all time, and there ought not to be any writing down for that particular asset. The house should be made to wipe its cost out in the period of its existence. If it was only built to last 50 years, then its cost ought to be wiped out in 50 years. If they did as in Glasgow, build to last 100 years, then the cost ought not to be wiped out under 100 years. There was one other thing, and this was where the sanitary inspectors and the lady visitors came in. It was absolutely true about the filthy tenants, but the difficulty was that the respectable poor for the sake of the money they paid for their rent were at the present moment compelled to herd with a class they desired to be quit of. The landlords or property owners ought to be compelled to have a care-taker in tenement houses of one or two tenements. He believed that the solution of the problem was to deal both with the tenants and with the houses.

MILK DEPOTS FOR INFANTS.

By Miss M. ARMOUR.

Sanitary Inspector, Leith.

IT is now over a year since the depot for providing milk for infants was opened at Leith, and the venture has been a pronounced success. Leith has earned for itself an enviable notoriety on account of its low death rate; but, as in other industrial centres, the mortality among infants is high. This mortality, as is well known, may be due to several causes, some of which may be prevented and others not. Chief among the preventable causes must be reckoned diarrhœa induced by neglect or ignorance in feeding the young. The question of depopulation has for many years disturbed France, and it is to that country we must look for the lead given to the establishment of depots for providing infants with sterilised milk. St. Helens was the first of the English towns to institute a depot, Liverpool, Battersea, York, and Bradford following suit, and now Glasgow and Dundee have followed the example of Leith.

The Leith Depot owed its origin to the recommendation of Dr. Robertson, the medical officer of health, who had reported upon the excessive mortality among bottle-fed children. One can, I think, logically reason that if parents will not appreciate the value and necessity for feeding their young upon clean, wholesome diet, a corporation should step in to assist them. It is all a question of education, and it is from that standpoint that the Leith Depot has been instituted and conducted. Too many people are apt to think that the milk is put into bottles and sold over the counter simply as a matter of daily routine. If this were the universal practice, the value of the milk depot would be slight. When an infant is put upon the sterilised milk, its future career is closely watched.

Objection has been taken to the establishment of milk depots at the instance of corporations; first, because one is not attacking the cause at its very foundation, and secondly, because by doing too much for careless parents one is but encouraging neglect and indifference. To the first argument no one can offer any strong objection, but were we to wait until the milk supplies of our cities were perfect we would assuredly have to

wait long. We are told that to reduce the diarrhœa mortality we must have a milk from scrupulously clean cows and collected under ideal conditions, the cows housed in perfect byres, and everything spotless about the animals and milkers. Our unanimous answer to these ideals must be in the affirmative, but seeing that we have been battling for a pure milk supply for a good many years, and are only very little further forward, the cry of the idealist must be allowed to echo among the dairy farmers before any good will come of it, but in many cases they turn deaf ears to the pleadings and teachings of public health officials.

Even were the milk collected at the cowshed and stored in the shop under the most cleanly conditions, its entrance into many houses would soon render it impure and deleterious. Try to imagine a pennyworth of fresh milk going into a farmed-out house of the worst description, and try to imagine where that milk can be stored. The air of the room is laden with the exhalations of several mortals, the bowl in which the milk is stored, though washed after a fashion, and the feeding bottle, if it has a tube, are both filthy and sour smelling. Is it possible under such conditions to prevent intestinal affections by crying out for a pure milk supply? Is it not much nearer the mark and more practical to say to these poor people, here is pure milk in clean bottles, give this to your infants and afford them a chance to battle through their early existence? I marvel at those who oppose the institution of municipal milk depots, grounding their opposition on the argument, that nothing should be done until the milk traffic is raised to a level of high excellence. There are not a few who believe that it is far better to teach the neglectful how to feed their young, rather than provide them with the milk mixed and ready for drinking. Those of us who are daily mingling with the poorer and more ignorant classes know only too well how the best of advice given at one moment is forgotten or ignored at the next. By all means let us preserve our policy of education, but let us also use every available means to reduce the great mortality among bottle-fed babies. The process of educating people in the common sense principles of infant feeding must necessarily be a slow one, and most of us know that to be the case. While I have pointedly referred to the poorer classes as being in need of education, you will agree with me that gross carelessness exists among those who ought to know much better. There are many mothers who know that their babies are taking the bottle, but are in absolute ignorance as to the ingredients and proportions of the infant's food. The motherly instinct cannot be very strong in these cases, else a little more interest would be taken in the upbringing of the

child. I merely mention that fact to show that our task of education is an extremely difficult one. If the well-to-do can be callous in spite of all they hear and read, how much more difficult must it be to teach the inhabitants of our slums who have neither the means nor conveniences to assist them.

To rear an infant the following rules must be obeyed :—If the mother is not able to suckle her child, she must feed it upon a common sense substitute, in known quantities, and at regular intervals. The object of the depot has been, firstly, to teach parents that a child's stomach can only accommodate with comfort a certain quantity of milk, and that to nourish the infant properly it must be fed at regular intervals. Accordingly, in each bottle is poured a quantity of milk, enough for a meal. Nine bottles are allowed to each infant, and these bottles suffice to feed the child for 24 hours. Also the use of the feeding tube is abolished, and each bottle is used in turn. Having gained this much, we feel that we have abolished three of the main causes of intestinal affections, for we know that the child is feeding from clean bottles, in carefully measured quantities, and probably the food is more regularly given. I do not wish to digress, but it may astonish you to know that despite the most careful instructions one finds bottles returned with vestiges of tea, sugar, broken biscuits, etc., in them. The baby begins to cry, a bottle is at hand, and its contents are given to the child. This breaks the sequence of feeding, and the stock of nine bottles is exhausted before the 24 hours have expired. The infant likes tea, so some is poured into the bottle which in turn is heated over a gas flame, the traces of the soot being there to inform us of what has taken place. It therefore does not surprise us to learn that now and again children fed upon milk supplied from the municipal depot suffer from diarrhœa.

One of the arguments advanced against the establishment of milk depots by corporations has been that the imperfections of the milk are but glossed over by sterilisation. This implies a gross lack of common sense on the part of those who supervise and control corporation milk depots. The milk supplied to the Leith depot is drawn from a special herd of cows. They are grazed on rich pasture land, their teats and udders carefully washed, and the milkers are required to use every means to be cleanly. The milk is passed through a filter and afterwards chilled. The cream is collected by a new and simple process, which consists in allowing the milk to stand overnight in a large flat jacketed tank, a constant stream of cold water circulating through the jacket. The cream contains over 35 per cent. of fat, and the milk is above the Board of Agriculture

standard. The depot consists of a front shop, a dwelling house behind, and a spacious cellar.

In the cellar are a boiler for providing steam, a water motor for brushing bottles, and tubs in which the bottles are washed and rinsed. A hoist communicates between the cellar and shop upstairs, the hoist being used for taking up clean bottles and lowering those returned after use. Upstairs is the steriliser, cooling tank, milk mixing apparatus, and shelves for storing the baskets containing the bottles filled with milk.

The milk is sent to the milk depot by train, the cans being locked so that they can only be opened at the farm and in the milk depot. It arrives from the railway station about ten, and immediately mixing operations begin. Having mixed the milk the bottles are filled according to the ages of the infants, and when the bottles are stoppered they are placed in the steriliser capable of holding over 300 bottles. Dr. Robertson and Dr. Mair conducted a long series of investigations last year, the results of which appeared in the *British Medical Journal*. These investigations dealt with the milk after it had been kept in the steriliser for half-an-hour at boiling point, and it was found that only in a small proportion of bottles was the milk actually sterile. The organisms which cause such diseases as typhoid fever, diphtheria, and tuberculosis were killed, but the bacteria which are capable of bringing on summer diarrhœa and gastro intestinal affections by peptonising action on the milk were not destroyed but kept in abeyance. Arguing from the standpoint that sterilised milk, or to be more correct milk kept at the boiling temperature for half-an-hour, may be impoverished and is not really sterile, it was determined to pasteurise the milk. This means that it is maintained at a temperature of about 170 degrees for half-an-hour, and subsequently cooled in a bath of cold water. This high temperature suffices to kill the disease-producing germs, and can also arrest the development of peptonising organisms. Were the bottles in their warm state placed on the shelves, the heat in the milk would tend to incubate the surviving peptonising organisms. By cooling the bottles and the milk in them the process of bacterial development is thoroughly cut short, and there is no gainsaying the fact that pasteurised milk is infinitely more pleasant to the taste than milk which has been kept at boiling point in the steriliser for half-an-hour or even less. Strictly speaking there is no need to attempt to do more than kill the disease-producing organisms, because the milk pasteurised to-day is used before another twenty-four hours have elapsed.

We have not been able to thoroughly reach those slum dwellers who

should patronise our milk depot. Their patronage is bestowed on other liquor depots. One shilling and sixpence spent on milk for an infant appears to be a lavish waste of money. Three shillings thrown away upon whisky is never considered to be any other than a natural consequence of pay day.

From the very outset our depot has been worked so that it will not be a burden on the rates, and in this it has been entirely successful. I do not think the same can be said of any other depot in this country. In the vast majority of instances the mothers are very keen on the upbringing of their infants, the result being that when they begin they continue until the child is fit to digest more than milk. Generally, infants begin at two months and continue until they are seven months old. Our experience has been that few infants are continued on the milk, because the mother's first glimpse of the quantities in each of the bottles so astonishes her that she refuses to believe how such tiny doses can nourish a healthy baby. That barrier of prejudice we must gradually knock down, because it is one of our fundamental principles to put into the tiny stomach only the amount science has taught us it is capable of properly and gradually absorbing. Over and over again we have instances of mothers who through want of perseverance and some self-sacrifice take their babies off the milk prepared for them by us, and substitute what they consider more satisfying food. The invariable result is that at the end of a week or two the mother returns with the statement that baby has gone back, continually cries, and is obviously in pain. While one is sorry that the tender infant should have been made the sufferer, one rejoices in the fact that another mother has been taught a much needed and never-to-be-forgotten lesson. It is to be kept in mind, too, that these mothers who have learned by bitter experience are valuable missionaries and advocates of our methodical feeding.

THE INCIDENCE OF SMALLPOX IN RELATION TO SANITATION,

as illustrated by the experience of the City of Liverpool.

By JOSEPH P. SWAN,

Chairman, Liverpool & District Committee, Garden City Association.

ABSTRACT.

THE object of this paper was to show that in Liverpool smallpox, and the other grosser forms of zymotic disease, had had a common natural history and had shown themselves to be amenable to common remedies. This was illustrated by a series of three tables. Table I. consisted of figures, compiled by Dr. Farr in 1875, showing the effect which healthy environment had upon zymotic diseases generally. This table demonstrated that the liability of the City of Liverpool to smallpox and other zymotic diseases was enormously greater than that of the country at large. The second table consisted of figures taken from the annual report of the Liverpool Medical Officer of Health for 1902, showing the annual average death-rate per 100,000 of the population from the principal zymotic diseases since 1866, from which it appeared that the marked decline of smallpox, and the more serious disease of typhus, during that period, had taken place *parri passu:* thus denoting a common natural history and the influence of common remedies. The same lesson was also emphasised by the third and last table, embodying particulars of the recent epidemic of smallpox in Liverpool, which showed that the incidence of the disease simply followed that of the greater zymotic class, and that it was also in almost exact ratio to the congested and generally insanitary condition of the areas affected. From this it was concluded that the only real remedies for the eradication of any of the zymotic diseases were to be sought in the patient and persevering application of the sanitary improvements which had already produced such vastly encouraging results. This view, it was further submitted, in conclusion, was also confirmed by the fact that, during the period over which the marked decline of smallpox referred to in Table II. had taken place, there had been practically no change in the

amount of the vaccination work done in the city. Hence the diminution which had attended smallpox, in common with the other more formidable forms of infectious disease, could only be reasonably attributed, not to vaccination, but to the causes which had been adequate to bring about the greater diminution which had taken place in the zymotic class of diseases generally.

Dr. Campbell Munro (Renfrewshire) referred to the statement by Mr. Swan that typhus fever and smallpox had a common natural history, and observed that if he had had any practical knowledge of the matter, he would not have committed himself to that suggestion. If Mr. Swan had suggested that smallpox and another zymotic disease, measles, were a good deal similar in their natural history, he would have had historical justification for the remark, because it was well known that in the early history of vital statistics smallpox was not distinguished from measles, the two diseases were lumped together, their respective natural histories being apparently so close. He thought the principal fallacy underlying Mr. Swan's observations and point of view lay in slumping the whole armoury, which in reality included about 100 different weapons under the one designation of sanitation. For instance, there was the excellent weapon of soap and water, to which he did not hesitate to ascribe great efficacy in dealing with smallpox, as well as sunshine and fresh air. Dr. Munro said that for a period of ten years he had been the medical officer of health for South Shields and Jarrow, and during that time he had experienced no fewer than fifty separate introductions of smallpox. In the case of the smallpox outbreaks not a single member of the hospital staff contracted the disease, whereas contrariwise four or five nurses were down with typhus fever, and one poor woman lost her life. The invariable rule there was that nurses were vaccinated when they came on duty and on the occasion of a new outbreak, but unfortunately there was no vaccination against typhus fever.

Dr. R. Evans (Warwickshire C.C.) said sanitation had really little or nothing to do with the prevention of smallpox. It was vaccination, carried out to the fullest extent as in Germany, which alone could eradicate the disease. Of course, where there was a perfect system of sanitation, the more malignant forms of disease were not to be found as formerly. He believed, however, that smallpox would be stamped out if the Government of this country would make primary and secondary vaccination compulsory.

Alderman Newton (Chairman of the Sanitary Committee, Newcastle-on-Tyne) thought that Mr. Swan's deductions were erroneous, and calculated to

arouse in the minds of a section of the community the impression that sanitation would do everything in the direction of eradicating smallpox. But while sanitation would do a great deal to improve the condition of the public health, and help to stamp out zymotic disease, and diminish the prevalence of many plagues with which we are more or less familiar, it was an admitted fact that sanitation would not eradicate smallpox. He thoroughly agreed with the author of the paper that whatever could be done to improve the public health would be an advantage to the community; the more sunlight that was let into the unhealthy parts of our great cities and towns, the better would be the conditions under which the masses of the people lived; but to compare typhus fever with smallpox was almost an absurdity. He might say to their friend from Liverpool that if he could induce his sanitary authority to reduce the number of slums in that city typhus would ultimately be extinguished.

Councillor S. Cook (Nottingham) contended that it should be remembered that smallpox is being continually imported into towns by tramps, and he considered that local sanitary authorities ought to have greater powers to deal with the vagrant classes. He thought that health officers ought to be allowed to put a certain number of tramps in quarantine, and to insist upon vaccination in those districts in which smallpox had broken out. He thought, too, that another cause of the spread of this disease was the frequent failure of young doctors to diagnose it properly. In many cases smallpox was mistaken for chicken-pox. In view of this fact, in Nottingham chicken-pox had been made a notifiable disease.

Mr. C. MacCullock (Greenock) urged the desirability of a system of revaccination, which, he pointed out, has successfully stamped out smallpox in Germany, and would do the same in this country if logically persisted in for a sufficient period. He believed the only real and reliable protection of communities against this scourge was systematic revaccination.

Mr. Begg (Glasgow) said that he had often asked what vaccination really was, and the only answer he had ever received to that question was given by a doctor in the witness-box, viz., "Whatever we say is vaccination is vaccination." It seemed to be clear that what was vaccination according to one medical man was not vaccination according to another medical man. Dr. Chalmers, the well-known Medical Officer of Health for Glasgow, had admitted that the evidence he went by was the characteristic mark upon the body. It did not matter whether a person said he had been vaccinated or produced a certificate to that effect, if the marks were wanting. As a matter of fact, the districts in Glasgow where smallpox raged most were as well vaccinated as the other parts less affected, but they were much less sanitary.

DR. J. C. MCVAIL (Stirlingshire) thought that if Mr. Swan would seriously put one or two questions to himself, he would not be able to satisfy himself that his thesis as to sanitation was correct. For instance, was it sanitation that had transferred smallpox from infant to adult life, and left measles and whooping cough as diseases of children? Nurses in smallpox hospitals who were re-vaccinated did not take the disease, while those who were not re-vaccinated did take it. Clearly sanitation would not account for that. It was just the same in an invaded household; smallpox attacked a very large percentage of those who were unvaccinated, but only a small percentage of those who were vaccinated.

COUNCILLOR J. T. BIGGS (Leicester) said Mr. Swan had contributed a paper of great value, and one well worth the serious consideration of everyone, whether they agreed with his conclusions or not. He thought it was a remarkable fact that typhus fever should have diminished in like proportion to smallpox. If the statistics were examined impartially he thought it would be found that this happy result was due to increased attention to sanitary measures. As far as the outbreak of smallpox in Gloucester was concerned, this was a case of absolute unpreparedness and neglect on the part of the authorities, and was not a question of vaccination or non-vaccination.

ALDERMAN WINDLEY (Leicester) supported the writer of the paper in the belief that sanitation is of very much more use than vaccination in stamping out smallpox. The experience in Leicester had been that ever since their sanitary measures had been improved, smallpox had been very rare in the town. Their medical officer of health in Leicester was of the opinion that the danger to the town from smallpox arose very largely from those who were vaccinated, for the reason that these persons took the disease very mildly and it was difficult for the doctors to diagnose the disease properly. In fact, many cases had been wrongly diagnosed, or not diagnosed at all, and the extension of the epidemic had been almost entirely due to that cause. He thought it was most desirable that every young medical man should be fully instructed as to the symptoms of smallpox. The deaths from disease had been kept as low as five or six per cent. of the cases in Leicester, which was considered by the advocates of vaccination to be one of the most lamentable towns in the country. He attributed the satisfactory results to excellent sanitation, and in conclusion, he appealed to the conference to set more store upon sanitary measures than upon vaccination or re-vaccination as the means for eradicating smallpox.

DR. PHILLIP BOOBYER (Nottingham) speaking of the payment of certain sections of the itinerant poor to induce them to be vaccinated, said that he had had experience in recent years of some of the roughest and toughest, and generally most intractable of habitual nomads in the common lodging-houses of

Narrow Marsh in Nottingham. Speaking generally, in the present state of the law, the only way to secure the vaccination of these people on a useful scale was by payment. He had paid such people a small sum—usually from 6d. to 2s. 6d. each—to undergo the operation, and subsequently found them board and lodgings in a common lodging-house, if they were disabled from work as a result of it. The fact that by this means he had been able to secure the vaccination or revaccination of tramps in the majority of cases—where by the incidence of smallpox this was necessary—went far in his opinion to shew the practicability of compulsory provisions to the same end. It was hardly necessary to say that preventive work—so far as smallpox and most other infectious diseases were concerned—was an entirely different thing among decent people in decent houses and neighbourhoods, from what it was among professional tramps in such slums as he had mentioned, where no more precautions against the spread of disease were ordinarily taken by these denizens, than by pigs in a state of nature. Whatever the possible value of cleanliness, theoretically considered in checking the spread of a disease like smallpox, no practical man with experience of smallpox among any of the poorer classes would listen for a moment to a proposal to substitute sanitary precautions for vaccination. The proposal was too absurd for a moment's consideration. So much for vaccination. In dealing with tramps, however, it was absolutely essential that authorities should be authorized during its epidemic times not only to vaccinate, but also to detain all habitual vagrants during the full incubation period of the disease. Better a little possible hardship to a few, than a monstrous wrong—as often under the present system—to huge numbers.

Bailie J. Taylor (Clydebank) explained that there was a population of 10,000 persons who came into Clydebank from the east end of Glasgow every day to work in the shipbuilding yards and the great factories. Many of these people came from districts in which smallpox had been rampant of late, but during the recent epidemic in Glasgow only eight cases had occurred in Clydebank. As chairman of the health committee of that town he attributed this circumstance mainly to the energies of the medical officer of health, the sanitary inspectors, and to vaccination. The people had been plainly told that they must either submit to vaccination, or look out for another job. Two of the eight cases he had mentioned were traceable to outside contact, and the other six had occurred in a Clydebank lodging-house, and had been imported by the tramp element. It was discovered that one man had refused to be vaccinated, and he took the disease and died, whereas three others who were vaccinated escaped infection.

Mr. Swan, in replying, remarked that he supposed it was inevitable that a paper of the kind he had read should provoke discussion and criticism on the merits or demerits of vaccination, but that had not been his intention or desire.

His object had been to get the subject looked at from the standpoint of sanitation alone for the time being. If it was vaccination which had produced the diminution of 48 deaths per 100,000 from the first decade, as shown in his second table, to 1·1 in the last he wanted to know how it was that it did not cause a diminution earlier, seeing that the extent of vaccination work done in Liverpool had been practically constant throughout the whole period. It was quite obvious that some other factors were brought into play, and the prime factor as he had endeavoured to show was the great sanitary progress which set in right from the time of the first decade. He would like to see some attempt made to ascertain what was the incidence of the disease in relation to insanitary property; to overcrowded and sub-let houses; to lodging-houses; and in relation to the tramp class. He thought such enquiries would fully bear out his contention that the diminution of smallpox, which had taken place of late years, had been due to the development of municipal sanitation.

The following papers were also read and discussed by the Conference:—

"The Work of Women Sanitary Inspectors in connection with Elementary Schools," by Miss M. L. Sharples.

"Sanitary Local Authorities and the Administration of the Public Health," by W. Cooper.

CONGRESS AT GLASGOW.

CONFERENCE ON INDUSTRIAL HYGIENE.

THE EFFECTS OF FATIGUE, ALCOHOL, AND TUBERCLE UPON WAGE-EARNERS IN THEIR WORK AND SURROUNDINGS.

By THOMAS OLIVER, M.A., M.D., LL.D., F.R.C.P.,
Professor of Physiology, College of Medicine, and Physician Royal Infirmary, Newcastle-upon-Tyne.

THE population of this country is largely made up of the working classes and their dependants. The health of the working and poorer artisan classes is a matter of considerable importance in the prosperity of the nation, for, when ill-health comes, it is they who fall back upon benevolent societies, fill our infirmaries, make their way into the workhouses and hospitals for incurables, and thus become a drain upon the financial reserves of the country.

The question as to whether the children of the working classes in the future will commence life with as good physique as their predecessors is one to which at the present time some attention is being paid. Several unfavourable conditions are operating upon the poorer working classes in our large towns, such as bad housing and slum life generally, improper feeding, excessive indulgence in alcohol by both sexes, which cannot fail to have a prejudicial effect upon the race, to make it feebler than its progenitors, and more apt to go wrong physically, mentally, and morally, in the rough work of life, and the changing conditions of time.

Note.—The Proceedings of the Conference commenced with an Address by Councillor J. C. Steele (*see page* 305).

WORK.

So far as adolescents are concerned, we have no hesitation in saying that work, within limits, makes for health and physical development, and that what constitutes the real canker of a nation is the increasing number of its men who live a life of idleness, and who are doing nothing to promote their country's prosperity. While thus extolling the beneficial influence of work, physical or mental, and the part it plays in human welfare, we must not forget that there are certain occupations that do not make for health. Workers employed in the so-called "dangerous trades" have their health constantly menaced by metallic and other forms of poisoning; work on the railways and in chemical factories is hazardous on account of the great risk to life and limb from accidents; certain occupations of an indoor character bring about slow deterioration of the body through breathing a vitiated atmosphere; and ordinary day labourers whose work is hard and attended by profuse perspiration and muscular fatigue, whilst requiring a sufficient amount of bodily rest, proper food, and a necessary amount of sleep in good air, often rise unrefreshed in the morning from having slept overnight in ill-ventilated and overcrowded rooms, their wasted energies not being replaced owing to the poor character of their food.

WAGE-EARNERS.

Under the heading of wage-earners there is included a number of occupations too numerous to mention, but which may be said to include almost every trade from the casual and regular day labourer, from masons, joiners, railway men, iron workers, factory hands, and miners, to police and postmen, whose wages vary in proportion to the skilled character of their employment and the demand for their work. Although the wages of the working classes have in many instances improved, the incessant calls made upon their earnings leave them with little surplus and in too many instances none at all. The high rents of houses in our large towns make it difficult for the labouring classes who are earning only 20s. a week to make both ends meet. Small wonder, therefore, when illness comes and the bread-winner is off work for two or three weeks, that the pinch of distress is at once felt.

Revising the statistics of the last census (1901), so far as the occupations of the people are concerned, it would appear that within the last few years a change has been creeping over this country. There has been a decrease in the number of people engaged in agriculture, a diminution in the number of those employed in making woollen, worsted, linen and

silk goods, whilst there has been an enormous increase in those employed in the building trades. The numbers in the building trades are triple what they were 50 years ago: a similar increase is noted in the people engaged in coal mining and ship building, while those employed in iron and steel manufacture, and in the production of earthenware and furniture, have doubled their number since 1851.

That occupation *per se* plays an important part in forcing up the mortality returns is at once apparent from the fact that in thirteen of our important industries no less than 4,513 lives were lost as the result of accidents during 1902, and 112,133 persons injured while following their calling during the same period. The railway service, in which 351,911 persons are employed, claims the largest number of victims from accidents of all kinds, and our docks are not far behind it; but so far as fatal accidents alone are concerned, it is in coal mining and in shipping that the largest percentage of deaths occurs. I shall not in this paper discuss at length the so-called dangerous trades and the evil effects that follow employment therein, but will deal in the main with occupations most of which are healthy and are largely followed out of doors, and in the exercise of which muscular energy is freely consumed.

Boiler makers supply me with a good illustration. The bulk of the men die from pneumonia and tubercular and other forms of lung disease, and from affections of the heart. The disease of the heart in these men is apparently of a degenerative nature, and is largely the result of physical strain, for it increases with every decade and is most fatal between the ages of 50 and 60. Tubercular disease, on the other hand, acts earlier, and is most fatal between the ages of 30 and 40. It is characteristic of boiler making, and similar occupations requiring the expenditure of a great amount of muscular energy, that the men become prematurely old, and have to be superannuated at an earlier age than men engaged in other ocupations.

Fatigue.

There is a limit to all kinds of work, physical and mental. It is the recognition of this fact that has created in this country the nine hours day. The conditions of labour have become so changed by the introduction of machinery, and the substitution of the factory for home industries, that the daily task of thousands of our working men and women is simply to tend machinery, and to make only a limited portion of a particular product. Thus employed they are robbed of one of the most necessary stimuli to exertion, while their intelligence is to some extent blunted by

the restricted nature of their work. When machinery was introduced, it was believed by the working classes that it would rob them of employment, but experience has shown that it has provided them with more work. Production has been increased, cost diminished, and wages improved. Machinery, however, has not lightened toil. If the hours spent per day in factories are shorter now than they were years ago, the demands made upon men and women are greater in the way of sustained attention and continuous service; for, owing to improvements, the machinery keeps revolving more rapidly, and turns out a larger quantity in a given time, so that nerve and muscle are severely strained in order to keep pace with it. The monotony of factory work, too, is a circumstance that of itself leads to fatigue. Impurity of the air in factories, excessive humidity, and high temperature of the atmosphere also contribute to it. In dealing with fatigue, as it affects the working classes, many things have to be considered, *e.g.*, the hard and exacting nature of the occupation, the poisonous and other emanations given off during work, the broken sleep at night, the impurity of air in the home, and the character of the food taken. Experimental physiology has shown that, when the muscles removed from a frog have been over-stimulated and thrown into such a state of fatigue as to no longer contract when stimulated afresh, the muscles will quickly recover their functional activity if some warm saline solution is injected into the blood vessels and the waste thereby removed. So too is it with working men fatigued at the end of a day. Sleep, properly cooked food, and a due quantity of some simple nutritious liquid are required in order to restore their jaded muscles to a state of healthy functional activity.

It is a current opinion that our artisan classes do not work too hard, and yet in certain trades (*e.g.*, where men are engaged in shipyards as platers and rivetters and are paid by the piece) these men work so hard that by the end of the week they are thoroughly exhausted. This system of driving or rushing, and which has been introduced into this country from America, is not only a cause of unwholesome fatigue, but of many of the accidents that occur in shipyards. It is possible to whip up the flagging energies of man so that for a time an increased amount of work may be got out of him, but the pace cannot be indefinitely maintained.

When muscle is fatigued physiologically, it responds more slowly to a stimulus, it contracts more feebly, and passes into a state of relaxation or inactivity more gradually than muscle in a normal condition. Fatigue in the human subject is not the same for every person. It is therefore unfair to place all people on the same level so far as endurance and capability for work are concerned. With some people energy is lost suddenly,

with others gradually. There is a personal element in this question of fatigue not to be lost sight of. Sex and age have to be considered, so too must the mode of life, the amount of sleep obtained at night, the influence of the emotions and mental states as well as the condition of the digestive organs. Since fatigue is a chemical process due to the action of the waste products of muscular activity upon the terminations of nerves in the muscles and upon the grey matter of the brain, the blood must be purified; hence the necessity of good air in the houses of the working classes, for it is by respiration that many of these harmful products are thrown out of the system.

I have examined men for life insurance, who in their younger days have been great athletes, who have taken part in all kinds of contests, rowing, running, cycling, football, etc. Rowers have told me that after pulling very hard in a race they have become perfectly blind towards the end of the contest, also that they could not get their breath and had to be lifted out of the boat. They felt as if they were being suffocated. During exertion breathing becomes quicker in order that more oxygen may be taken into the lungs and at the same time the waste product carbonic acid may be got rid of. When people breathe more rapidly the temperature of the body falls, owing to greater evaporation of water by the lungs, and also the lower temperature of the air entering the lungs. The blood of fatigued animals is poisonous to other animals, for if injected into them it produces fatigue.

The Phenomena of Fatigue.

In ordinary fatigue, muscles and nerves are both affected. Workmen who are in the habit of using their eyes much know and appreciate the value of a Sunday's rest. Towards the end of the week teachers feel tired, so, too, do the children, and the work done then is never satisfactory. When a person's brain or muscle is already fatigued, and additional work is imposed upon him, this renewed demand acts more harmfully than would a heavier task performed under normal conditions. Only on rare occasions, therefore, should muscles be allowed to be worked to the point of extreme exhaustion.

After all it is not so much the amount of work done that causes fatigue, as the peculiar call upon the nervous and muscular energy required to accomplish it; hence the tired feeling caused by some kinds of work is greater than that caused by others. It is not always a matter of long hours, but of the intensity of the work while it lasts that tells. Since fatigue is a chemical process arising from the action of toxic blood upon nerve tissue, it might be well worth considering how far hard and monot-

onous labour performed by women in the latter months of pregnancy, in an overheated factory for example, is responsible for an enfeebled offspring, and therefore plays a part in the physical deterioration of the race.

EFFECTS OF MUSCULAR STRAIN AND FATIGUE.

As a consequence of fatigue, work can no longer be done well, and there is a tendency to accidents. Prolonged overwork and monotony of employment predispose the individual to ill-health and create a taste for stimulants, also for unhealthy recreation and love of excitement such as is offered by theatres and music-halls. Doubtless, the peculiar restlessness of the age, the love of change so characteristic of modern times, are also responsible for this desire to be amused. As illustrating some of the effects of physical fatigue and of prolonged mental strain, mention need only be made of the railway accidents that have been traced to the loss of brain power, through fatigue and long hours, in signalmen, to the paralysis that develops in the hands of clerks and piano-players consequent upon the over-use of their muscles, also of the part played by fatigue, quite apart from lead poisoning, in men who are engaged in file-cutting by hand. Hammermen in our iron factories, owing to the excessive strain they are put to, develop disease of the aorta, ending in aneurism; also disease of the valves of the heart.

Rivetters who use the hydraulic drill suffer in a similar way. One of the results of this excessive muscular effort and strain upon these men is that many of them die before the age of 50; others survive, but in them degenerative changes gradually appear in their organs of circulation which unfit them for strenuous labour, cause them to break down in health every now and then, and finally land them in a condition of permanent ill-health. Often other factors are present as well as strain. Take, for example, one circumstance that at present is attracting the attention of our military authorities, namely the large number of young soldiers who break down in their heart a few months after joining the army, which is attributed to the severity of their exercises. Hard as these physical exercises are, we have to remember that these are acting upon constitutions previously ill-nourished before the men joined the ranks, and which have since become impaired in another direction by the freer habits and the social irregularities of a young soldier's life.

ALCOHOL.

It is still a debatable point as to whether alcohol is a food. Some medical men affirm that it has a certain value in this respect, that alcohol

in its decomposition in the human body is oxidized, and energy thereby liberated. Admitting that one gramme of alcohol either outside or inside the body is capable of yielding seven calories or units of heat more than one gramme of proteid, can alcohol be so utilised in the system as to spare the other elements of the food, or to prevent the tissues of the body from being burned? If it saved fat from combustion it would be a good food, and if proteid from the same fate it would be a still higher kind of food. Animals when given alcohol resemble men who take stimulants with their food, in so far as they lay on fat. To healthy vigorous men there is no need to give alcohol in order to have it taking the place of food, for in health the tendency is to gain weight or maintain it, certainly not to lose it. Alcohol first stimulates and then depresses the neuro-muscular system. Under its use muscular work may be at first temporarily increased, but it is soon decreased, and is not reliable. Type-writers, *e.g.*, make fewer errors when they are not taking alcohol. Alcohol benumbs the sense of fatigue and leads to an extravagant expenditure of energy. When taken in excess, and over a lengthened period, it sets up changes in the internal organs that lead to an untimely death. The ravages caused by alcohol far outweigh any advantages that can be claimed for it in the way of food; besides, even were it the best of food it would be far too expensive. Where money is spent by the working classes freely upon alcohol they cannot be properly housed and fed. It is impossible to estimate the amount of ill-health and family distress created by the immoderate use of alcohol. Digestive derangements, cirrhosis of the liver, cardiac degeneration, and diseased arteries, to say nothing of their baneful effects upon the nervous system, leading to idleness and permanent unfitness for work, are some of the evils attendant upon the misuse of stimulants.

I should not be far wrong if I said that the bulk of the diseases for which working men are admitted into our infirmaries are the result of alcoholic intemperance, exposure to cold, strain at work, and syphilis. Alcohol reduces the vital resistance of the individual so that he is unable to bear strain at work, and by making him careless of exposure to cold it lays him open to all forms of acute pulmonary affections, but especially to tubercle. It is also a frequent cause of accidents in factories, shipyards and dockyards. Knowledge of the previous habits of workmen and of the way in which they spend their evenings are circumstances that ought to have fair consideration extended to them in courts of justice, when after accidents, claims are lodged for compensation for injury. Only a few weeks ago a French court dismissed a claim for compensation for injury received at work, the evidence having shown that the workman at the

time of the injury was under the influence of drink. It is believed that several of the fatal accidents in our dockyards and on board ship, also some of the wrecks that have occurred shortly after ships had put to sea, have been due to men being in a state of semi-intoxication and unfit for work. Over and above the immediate and remote effects of alcohol upon the individual, and the impoverishment of the home and family caused by it, we cannot overlook its possible effects upon the progeny from a hereditary point of view. And is there not too another sad side to this picture, viz., the encouragement given to the wives of working men to drink, through the example set them by their husbands? Whatever doubts there may be in regard to the physical degeneration of the race, there is none as to the diminishing birth-rate in this country; and while there are many causes leading up to this, the increasing amount of alcohol drunk by women, and the more selfish lives they lead, are responsible for many sterile marriages.

Dr. Lonnet (Conférences sur l'Alcoholisme, p. 152) tells us that in Brittany, of 107 women who died before the age of 29 from the consequences of alcoholism, eight had not had any children; of the other 99 there were born only six children, and these were delicate or deformed. These same women before becoming addicted to alcohol had had 28 children, all of whom were healthy and vigorous. Thus upon the wives of the working classes, even more than upon the husbands, the baneful effects of alcohol are only too apparent. Working men ought not to take alcoholic drinks during working hours. All such commodities as beer and stout carried into the factories at the dinner hour or during working hours into laundries should be forbidden. I have known young children who were in the habit of carrying beer to their father in the factories, take regularly every day a swill of the beer they were carrying, and, as a consequence, develop cirrhosis of the liver.

After all, the stimulating effects of alcohol do not last long—they are soon followed by depression. Can any working man who is intemperate extract from his blood, saturated with alcohol, the necessary energy for healthy muscular activity? Dr. Gilbault, in his experiments upon work and alcohol, found that the amount of work accomplished by himself upon the ergograph after taking alcohol was less both on the same day and that succeeding it, than when no alcohol was taken. Alcohol leaves behind, in too many persons, a feeling of lassitude which tempts to the fresh taking of stimulant. Besides, even while during the period of temporary stimulation a greater amount of work may be done, there comes inevitably a period of prostration and of lessened production.

Tuberculosis.

While within the last few years there has been a notable decline in the mortality from phthisis in this country, the disease still claims too many victims, often, too, at a comparatively early age. Since phthisis is met with more frequently among the poorer working classes than the well to do, the subject of tuberculosis is essentially a workmen's question. It attacks men who follow certain trades more than others. The presumption, therefore, is that occupation is of itself, directly or indirectly, a cause of pulmonary consumption. Dr. J. M. Cowie, of Manchester (*Tuberculosis*, January, 1904), has published statistics of certain occupations which show that while the incidence rate of tubercular disease per 1,000 males over 15 years of age is for all engaged in occupations 4·80, it is in the case of costermongers, 12·32; porters and watchmen, 12·29; workers about docks, 8·4; brick, cement, and earthenware workers, 5·8; hotel-keepers, 5·2; coal-miners, 1·59; and gardeners, 1·10. Cowie found that the incidence, not the mortality rate, of phthisis was highest in males between the ages of 45 and 65. In females it is earlier, viz., 25 to 45 years of age, a circumstance to be explained by the fact that the years from 25 to 45 correspond to the child-bearing period of women. It is known that both during pregnancy and after a confinement women are especially liable to phthisis. Three or four decades ago females suffered more from phthisis than males; now the tables are reversed, for Dr. Tatham has shown that while from 1851 to 1865 more females died from phthisis than males, the mortality from this disease has since 1866 been uniformly greater in males. Why costermongers, male and female hawkers, and street sellers who are leading an outdoor life should exhibit the highest incidence rate from phthisis is at first a little difficult to understand. There is not the least doubt that exposure to cold and wet, the exercise of the voice, intemperance in alcohol, and irregularities in getting proper meals, the scanty earnings and overcrowding in their homes and lodging-houses, have much to do with the high rate of phthisis met with in these people. Since life in the open air is the modern method of treating phthisis, and is that which has given on the whole the best results, it seems strange that people following the occupations just mentioned should exhibit a high rate from phthisis. There must be something, other than the occupation, to explain this tendency to phthisis.

Dust and Impurity of the Atmosphere.

Inhalation of dust, as in the case of potters, the tin-miners of Cornwall and the gold-miners of the Transvaal and elsewhere, is a frequent cause of phthisis, which if not tubercular in its inception becomes so later on. The

overheated and excessively humid atmosphere of textile factories is also provocative of the disease. In France at the present time this is particularly noticeable in the woollen thread industry, in which it is necessary to have a fairly high temperature in order to prevent coagulation of the viscous material which surrounds the woollen fibre, and to favour the operation of stretching. In addition to a high temperature moisture is also essential, and often this is excessive. Many of the factories are only ventilated in the evening after the workpeople have left. The air of the workrooms instead of containing only three parts of carbonic acid per 10,000 may contain five, six and even nine parts, and on bacteriological examination it may contain as many as 100,000 micro-organisms per cubic centimetre. The air too is polluted by the emanations from the bodies of the workpeople themselves, while its odour is rendered unpleasant by the decomposition of the oil used for lubricating the machinery. Besides, the workpeople often make things worse for themselves by stopping the running of the fans. In Lancashire I have been often struck by the careless manner in which the women dress on leaving the heated factory: they are too lightly clad. At Roubaix and at Rouen, centres of the textile industries of France, the mortality from tubercolosis is $\frac{1}{6}$th to $\frac{1}{7}$th of the general mortality of the two towns. At Lille, also the seat of the trade, the mortality from the same disease is 45 per 10,000; while in the metalliferous district of Valenciennes it is 39·5 per 10,000. At Calmettes, near Lille, 519 persons recently sought advice at the dispensary on account of tubercular disease of the lung; of these 109 were engaged in textile factories.

Dr. Niven attributed the disease to excessive use of alcohol and to infection by the tubercle bacillus through the men frequenting ill-ventilated and improperly swept public-houses. In addition to the possibility of tubercular infection from this source, there is for all men and women employed in factories and workshops the danger of becoming infected at their work by diseased comrades spitting on the floor—the sputum drying and the tubercle bacilli subsequently rising into the atmosphere. Dusty occupations, the breathing of impure air, also the presence in the workroom of consumptives who are careless in the disposal of their expectoration, are the main causes of industrial pulmonary phthisis.

TRAUMATISM OR INJURY.

It is still a disputed point as to how far injury to the chest wall can be regarded as a cause of phthisis. I have attended persons suffering from phthisis whose explanation of their illness was that they had been

quite well until they received an injury to their chest, followed shortly afterwards by a spitting of blood, and subsequently by cough and wasting. How far the injury was the real cause of the disease of the lungs it is sometimes difficult to say.

It is easier sometimes to imagine that the lungs in such cases were not quite healthy before the accident than to prove the relationship between traumatism and phthisis, and yet there are cases of lung disease in which injury was undoubtedly the cause of the malady. Apart from infected milk (for bovine and human tuberculosis are by British pathologists believed to be one and the same disease, and therefore interchangeable), overcrowding in the home is, by lowering the general health, both a frequent cause of phthisis among the poorer working classes, and a fruitful means of spreading the disease. The medical officer of the County of London in a recent annual report (*Tuberculosis*, April, 1903, p. 241), after pointing out how the rate of mortality from phthisis has declined the last few decades, shows that the death-rate from phthisis varies with the density of the population, viz., 2·81 for Holborn, 2·29 for the City of London, 1·10 Paddington, and 0·90 for Lewisham. As contributory causes of phthisis, poor feeding and insufficient clothing must not be forgotten. These, like some of the other causes alluded to, act indirectly by reducing the vital resistance of the individual.

It is difficult to estimate the cost of tuberculosis to the country from a monetary point of view. Apart from the loss of life which the malady entails, there must be included the loss of wages during the long illness, the monies given by the State and by charity, and the sums spent on medicine, etc., to say nothing of the indirect suffering which the illness causes. It is estimated that the 7,500 deaths from phthisis in London alone in 1901 meant a loss of £3,000,000 to the country. It is upon wage earners that tuberculosis falls the heaviest.

In Glasgow there is a large part of the population lodged in one-apartment houses, but in this respect it is surpassed by Edinburgh, Aberdeen, and Dundee. Dr. A. K. Chalmers, Medical Officer of Health for the City of Glasgow, has shown how much higher the death-rate in one-apartment houses is compared with that in tenements of two and three rooms, and more particularly as regards infantile mortality. Grouping various districts of the city together, the basis of the grouping being the level of the death-rate of individual districts, Dr. Chalmers found that in one district, while the death-rate in houses of all sizes was 31·1 per 1,000, it was among the one-apartment population 41·2; in another, while the death-rate in houses of all sizes was 25·8, in one-apartment houses it was 35·9; in yet another

group, while the death-rate in houses of all sizes was 17·8 per 1,000, it was in one-apartment houses 33·1. Taking the deaths in one apartment houses in Glasgow during 1901, I find that of 3,405 deaths recorded, 1,268, or a little more than one-third, were due to phthisis, tuberculosis, and respiratory diseases.

The death rate in our large tonws is diminishing, notwithstanding the increasing numbers of people that are flocking into them, and the difficulties connected with their housing. This diminution in the death rate in towns may to some extent be the result of a wider-spread knowledge of the laws of public health. There is still, however, a rate of mortality in certain occupations, and associated with slum life, that is disquieting and calls for redress. In the rear of civilization there have always trod disease and death. New industries are springing up; new developments keep opening out that ought to minister to man's comfort and promote his longevity; and yet, alas! these too often mean ill-health and early death to those who follow them. Surely such is neither the aim nor the end of civilization. It was never meant that such products of human invention as improved machinery should be injurious to man.

[*For Discussion on this Paper, see p.* 724.]

NOTES ON THE MORTALITY OF OCCUPATIONS.

By A. K. CHALMERS, M.D.,

Medical Officer of Health, Glasgow.

THE time at our disposal does not admit of a very extensive review of the diseases of occupation, but I shall ask you to look at three groups as illustrating the variations in the death-rate which occur at certain ages.

And first of all I will ask you to consider what may be regarded as the normal death of males in Glasgow at the age periods when the influence of occupation begins to be felt, viz., 25–65.

According to the last census the males living in Glasgow between the ages, 10–65, numbered 288,039. Of these, 163,029 were living between the ages, 25–65, and among these, in the 3 years 1900–1–2, 8,681 deaths from all causes occurred. When these deaths are arranged in decennial periods as at ages 25–; 35–; 45–; 55–; and regarded as occurring among three times the census population living at each age period, the death-rates are as stated in the following Table, in which is included, for purposes of comparison, the compared rates of two earlier periods calculated on the central population of each:—

GLASGOW.—*Males: Death-rate per 1,000 living at certain ages in several periods.*

PERIOD.	25–	35–	45–	55–
1881—1890	9·3	15·2	26·5	45·8
1892—1900	8·2	14·2	24·8	45·5
1900—1—2	7·8	14·3	25·9	47·1
DEATH-RATE OF MALE WORKERS IN CERTAIN OCCUPATIONS (1900-2).				
(a) Dress Materials	9	15	33	61
(b) Brick, Cement, and Plaster	13	18	44	42
(c) Labourers	17	28	52	96

In the first two periods the rates are calculated on the populations as estimated for Life-table purposes, while in the last the population is obtained from the number of males, occupied and unoccupied, ascertained to be living at the last census. The rates, therefore, are fairly comparable, and may be taken as a standard by which to measure the effects of occupation on groups living at corresponding ages.*

In classifying all males as to occupation, the Registrar-General arranges them in 23 groups or orders and 83 sub-orders, and having obtained a knowledge of the death-rate for all orders at given ages, the divergencies of the groups may be noted.

Workers in Dress Materials.—Our first illustration may be taken from the workers in dress material, and will illustrate the effects of dust in textile fabrics, combined in many cases with imperfect ventilation, and in some with fluctuations of temperature.

At the ages already stated the death-rates here are 9, 15, 33 and 61. A further illustration is afforded by the workers in brick, cement, and plaster, and the figures at the same ages run as follows—13, 18, 44, and 42. To a considerable extent these variations must be regarded as arising from the conditions of occupation of the respective groups. My last illustration is from the class of unskilled labourers, and the rates are 17, 28, 52, and 96. I may explain that the term labourer here includes unskilled labour of all kinds. Following upon the reference which the President has made to the Comparative Mortality figures of the Registrar-General for England, I endeavoured to adopt a scheme which would have given comparable results; but found that the grouping of occupational deaths did not admit of a sub-division of labourers into various kinds, such as shipyard, foundry, quay, masons, labourers, &c., and so I had to deal with all labourers together, and make them representative of the great class of unskilled workmen.

One striking result of this grouping is shown when a Comparative Mortality figure is prepared for each. If we regard the deaths from all causes of all males as being represented by 1,000, then the corresponding figure for the group of workers in dress material is 1,196; for plasterers and cement workers, 1,341; and for labourers, 2,017: which represents more than double the rate at which all males are dying.

I would like to take you one step further, and consider the incidence of phthisis among the several groups with which we have been dealing.

* For convenience in comparison the rates for three groups of workers are placed at the bottom of the columns showing the death-rate at corresponding ages of all males.

Taking the same ages, we shall deal first with the dress and textile fabrics group. Here the conditions of work are necessarily indoors. Eighty-eight per cent. work for employers, and consequently a large proportion will work in factories. The death-rate from phthisis among them was 3·6, 5·7, 5·9, and 5·9 per 1,000 at the age periods 25, 35, 45, and 55 respectively. Again, among the workers in brick and cement, the rates are 3·5, 5·0, ..., and 3·5; while among the labourers the rates were 6·5, 7·1, 8·6, and 5·5. Comparing these with the rates obtaining among the professional classes, including ministers of religion, lawyers, doctors, artists, &c., the death-rate from phthisis in this class was at the same ages 2·1, 1·9, ·7, and ·5. From these simple illustrations, I hope you will be able to value the varying results of occupation upon health. If one asks the question, Why are the labouring classes suffering so much more than others? I think we will get our answer by referring to Dr. Oliver's paper which has just been read. Their occupation is of an extremely exhaustive and irregular character; irregularity in employment often means indifferent food, and the evil effect of this is too often supplemented by over-indulgence in alcohol. All these in time produce the sinister results on the death-rate which we have just seen.

A Paper was also read on "Trade Diseases and Accidents, and their prevention" by Alexander Scott, M.D.

[*This discussion applies to the papers by* Prof. Thomas Oliver, Dr. A. K. Chalmers, *and* Dr. Alexander Scott.]

Dr. W. F. Dearden (Manchester) said that he had worked in a similar direction in Manchester to that of Dr. Scott in Glasgow as certifying surgeon, and he could from experience endorse his remarks, which deserved general attention. Dr. Scott had suggested a perfect system of medical inspection in factories and workshops. As most of those present knew, there is to-day a limited degree of medical inspection, but this was confined to factories and to workers of certain ages. Any child or young person up to 16 years of age had to pass the doctor immediately after obtaining employment. Factory surgeons knew what a great benefit that had been to the population, and he had got tables together for over 3,000 rejections for medical reasons, and roughly the proportion to all examinations came to about 0·5 per cent. That figure might not look very great, but when they reflected that it dealt with the whole of the young factory workers

of the country, they would doubtless admit it indicated that a very important work was being done through this system of medical inspection. While he agreed with Dr. Scott's views very largely, he was afraid that what had been advocated that morning was beyond their utmost hopes for a long time to come; still, at the same time, they might look for a little improvement in certain directions. The points to which he wished particularly to allude, had relation to women workers. Dr. Oliver in his paper had referred to the change of occupation, and this change was really very remarkable, especially as regards the occupation of women and young girls. During the last fifteen years of his work a great alteration had taken place in the occupations of the female young person—that was the technical term—in factories and workshops. A great deal of the work formerly done by boys is now done by girls. As an illustration they might take French-polishing; the woodwork was done very cheaply, and the manufacturers could not afford to pay boys, who wanted extravagant wages to do the finishing, so put on girls to do the work. In many other directions the same change could be noticed, girls now being employed to do the work previously done by the other sex: they were paid very poor wages, and if they did not do the work properly were in some places heavily fined. There was also a great deal more of the regular work of girls done nowadays, such as in making up dress goods, underclothing, and things of that kind. Owing to the introduction of electricity these girls now came under the certifying surgeon. Previously their work-places were held to be workshops; but with the use of electricity these places come under the factory regulations. Now such women workers had the advantage of a medical examination, and his experience was that places of this kind generally had more rejections than other established works under the Factory Act. He thought that Dr. Oliver's remarks as to fatigue showed how necessary it was for them to be particularly careful with the workers of the female sex, who were not calculated to stand the same strain as men or boys. Women were employed on work that produced just as much if not greater strain than in the case of men, and therefore for that reason he thought there might with advantage be more medical inspection than there is for girls. He could not see any reason why a girl should be medically inspected up to 16 and not up to 18, or why a girl should be medically inspected for work in a factory and not for work in a workshop. He contended that the inspection could be extended to girls working in workshops as well as in factories, and the inspection age raised to 18.

DR. ELLIS (Stourbridge) said he had been equally interested in Dr. Scott's paper, and supported all that had been said in praise of it. He was a certifying surgeon in a district where lead poisoning had been a very serious danger to the workpeople, and he rose to support the view that there are good effects from definite and well carried out plans for the protection of the workmen against the injurious effects of the trade. Fans had been established for preventing the

dust from what is called the putty used for polishing of glass in these works, and it consisted of a large quantity of lead oxide. The dust that used to be produced by this work would seriously affect the health of the boys who commenced early in life to assist the workmen by supplying the putty paste. As a result of the work of pioneers in the investigation of lead poisoning or the ill effects of this particular trade, the boys were prohibited from supplying this putty in the way they did formerly, and could not come in contact with it; they were screened off, so they did not suffer to anything like the extent they used to. Indeed, it was now an extremely rare thing to find a boy up to the age of eighteen suffering from lead poisoning, whereas ten or fifteen years ago it was quite a common thing to find that lads after two or three years' work at the trade were suffering from it. With regard to other branches of the work, the men work in close rooms at long rows of benches down each side, and there used to be a considerable amount of dust in these works and in some of the workshops. No doubt there is dust now, but in consequence of the arrangements that were made for providing washing accommodation for these men in separate rooms, that disease has been considerably reduced. He gathered that Dr. Scott had said something with regard to intemperance being a cause, or one of the principal causes, of lead poisoning. That did not correspond with his own experience in these matters: the men working in the glass-coating shops were not intemperate men, as a rule. Indeed, on the contrary, they were a steady class of men who did not earn very high wages, and did not drink very much for the good reason that they had not got the money. But the effect of lead poisoning had been very disastrous among them twenty years ago, though it had very much diminished now. In one or two workshops in which they had acted upon some suggestions he made, to what he might call the better and more interested class of employers who had paved the floors and frequently cleansed the shops, the incidence of the disease had been largely reduced; indeed, in two of such shops he had not seen a single case of lead poisoning for twenty years, and the same workmen had worked there for ten or fifteen years. One man, who had worked there the whole time, had previously suffered severely, had given up the work for a year, and then gone back to the trade and had been perfectly well. He attributed these excellent results entirely to the dust that used to lie thick on the floor, having been dealt with, and the air made very much more pure.

Councillor J. Burgess (Glasgow), as a textile worker for 20 years, felt qualified to say a word about the two papers. He noticed that all the papers had laid considerable stress upon the subject of the use of alcohol. He submitted that in that section they were not discussing the production of a perfect, or an impregnable workman, the man whose constitution could not be undermined in any way, or one upon whom the provisions of the Factory Acts and factory administration could have no effect at all. But they were rather dis-

cussing the conditions in the factories which could be modified by legislation, or by the wise management of those factories. Therefore, dealing with the subject from that point of view, and not with the grown person, but with the effect of the factory upon the child or young person, against whom this charge of alcoholism could not be justifiably directed, he would ask them, if they went into textile factories (of these places he had had 21 years' experience), what did they find? Taking the young person, in his day the age limit was 8, and he was working full time at 11, they found that person working in an atmosphere in which it was impossible to live healthily. The steam would fill some departments, or the fluff would lay an inch thick everywhere in others; that contaminated the air which had to be breathed all day by the workers. Then there was the use of china clay in the weaving sheds, and this produced enormous dust, and so the atmosphere had to be damped. Originally this was done by swilling the floors with buckets of water, on which the women had to stand all day, but now the more scientific method was the injection of spray steam. So that if they went into any factory in the Lancashire district they would find that the workers had to work all day in an atmosphere of dust and steam! their clothes would become sodden and damp, and in these wet garments they would have to go out into the street. This was a great cause of bronchial affections and tuberculosis in the textile districts. The medical officer of Glasgow had that morning put before them a most valuable statement, and attention should be directed to the last line of it, the labourer's phthisis death-rate. Now he ventured to say that was not an occupational death-rate at all, and few workmen got a more healthy occupation, having variety and fresh air; that death-rate was rather, in his opinion, a one-apartment death-rate.

HEALTH ASPECTS OF SOME OCCUPATIONS FOR WOMEN.

By Miss A. J. SAFFORD,
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IN this paper I propose to consider a few of the occupations followed by women in the City of London. The tens of thousands of women who crowd daily into the City are engaged in a great variety of pursuits; an attempt at classification gives over seventy distinct occupations, each of which is capable of a bewildering number of sub-divisions, so that it is most difficult to speak in general terms of any. None of them can be classed as a dangerous trade, for the risks to health which undoubtedly exist are such as can be obviated by intelligent compliance with the elementary laws of health. No specific disease can be said to follow the infraction of these laws, but if the results are not obvious they are none the less important and far reaching. The general undermining of health and enfeebling of the constitution, with the consequent predisposition to disease which are inevitably produced by working under unhealthy conditions, cannot be lightly disregarded.

Speaking generally, the following defects will be found to a greater or less degree in all places where people assemble permanently to do work of some kind or another: deficient natural light, insufficient ventilation, unreasonable temperature, overcrowding, insufficient or unsuitable sanitary accommodation, dirty walls, ceilings, floors.

Deficient Natural Light.—I mention this first because it is the only defect which is not recognised by either factory or health Acts, and because of its importance. The power of sunlight in destroying microbes, or at least in attenuating their virulence, is well known, and dearth of sunshine is one of the most potent predisposing causes of phthisis. In a room with little natural light, artificial light must be used during the greater part of the day, and when gas is used as an illuminant the vitiation of the air will be very great and the temperature of the room will be unduly raised.

Unreasonable Temperature.—Section 6, Factory and Workshop Act,

1901, requires that in factories and workshops adequate measures must be taken for securing and maintaining reasonable temperature, and adds the important proviso that the "measures so taken must not interfere with the purity of the air of the room." This is intended to do away with the practice of heating work rooms by burning ordinary gas jets.

The pernicious effect of this method of heating may be better realised when it is remembered that the combustion of gas through the ordinary gas jet produces 4 cubic feet of carbon di-oxide (CO_2) per hour and 12 grains of sulphur per 100 feet of gas consumed. Coal fires are often impracticable in work rooms, and gas stoves, unless provided with efficient means of carrying off the fumes, create an unwholesome atmosphere. Hot-water pipes are probably the best means of heating large rooms, as the heat is equally distributed, and there is no vitiation of air.

Ventilation and Cubic Space.—The cubic space required by the Factory and Workshop Act, 1901, in factories and workshops, (250 cubic feet per person) is obviously the very least that can be considered sufficient, and constant change of air will be necessary if the air of the room is to be kept comparatively pure. The problem is how to get that change of air. Window ventilation is of little practical use except in summer—on the warm days, in summer I should say. On cold days, when the choice is between sitting in a cold room with fresh air or in a warm and stuffy room, it is hardly surprising that heat is preferred to fresh air. Given adequate means of securing a reasonable temperature, an arrangement of Tobin tubes at about 3 feet from the floor level, with corresponding air outlets (carefully planned to prevent down draught) near the ceiling, would probably prove effectual. It is rare indeed to find any room where the ventilation is satisfactory, partly owing to the fact that whatever system of ventilation is adopted, intelligent use thereof is necessary to make it effective, and very few people are intelligent on the subject of ventilation. As Professor Peter forcibly expresses it, "one who would be horrified at the idea of drinking water from the sewer will without the least hesitation breathe the air of a concert room or theatre, a veritable air sewer," and he proceeds to point out that the vital system deprived of the oxygen indispensable to life is enfeebled in a way analogous to the gradual starvation resulting from deficiency of food.

Sanitary Accommodation.—Nearly half the defects found in workplaces are in connection with the sanitary conveniences. They are found communicating directly with the workrooms, badly ventilated, and unsuitable in various ways. When persons of both sexes were employed, there was

often no proper separate accommodation; this was especially the case in restaurants. The Secretary of State's Sanitary Accommodation Order of February 1, 1903, has been adopted by the Corporation of London as the standard of sufficiency and suitability.

Special Defects in some Types of Occupations.

(A.) *Workshops.* (i.) *Dust producing processes.* Feather dressing.—In the process of feather dressing a very fine light dust is given off which is liable to produce diseases of the bronchial tubes and lungs, and according to Dr. Oliver sometimes induces ophthalmia. In these work rooms special means of ventilation are necessary to draw off the dust from the workers. In some work rooms troughs of water have been placed down the centre of the tables where the process is carried on in order to catch the dust, and this has had good results.

Furriers.—In furriers' workshops men are employed in cutting and arranging the fur, which is then sewn together by women either by hand or machine. Both in cutting and sewing a considerable amount of dust, containing particles of hair, is produced, and finds its way to the lungs of the workers. There is a special danger in this dust in view of the possibility of its being a vehicle of anthrax contagion. The brushing is not done in the general work room, but sometimes in a separate room, more frequently in the open air. As this is always man's work, we are not now concerned with the evils to health it may involve. Good means of ventilation and scrupulous cleanliness and the constant removal of fur clippings and dust of all kinds should be strictly enforced in furriers' workshops.

(ii.) *Workshops in which Gas is used in the process carried on.*—The use and abuse of gas in workshops is a subject which would afford ample material for the whole of a paper.

In practically all trades where clothing is made, irons of some kind are used, and the usual method of heating them is by a gas stove, or by means of gas burners inside the iron. The injurious products of gas combustion are easily removed in the case of stoves by placing a hood over the stove, connected by a flue to the nearest chimney shaft or to the external air. Gas irons are a constant source of trouble, and should when possible be placed in specially ventilated rooms apart from the general work room. Electrically heated irons are used in some workshops, and it is to be hoped that they will be increasingly adopted. Gas is also used to heat various kinds of gauffering and accordion pleating machines.

Cardboard-box Making.—In this trade and also in frame making pattern card making, and the like, gas rings or stoves are used for heating glue. The smell of the glue added to the fumes of gas makes these work rooms particularly unpleasant, and except in the heat of the summer windows will not be opened lest the glue should cool.

Artificial Flower Makers.—In these work rooms little gas stoves are used for heating the tools, the stoves are placed on the tables, one to every four or five workers, and certainly require a hood and flue or other means of carrying off the fumes.

(B.) *Laundries and Receiving Offices.*—Laundries are liable to all the defects found in workshops, together with their own special ones. In large laundries the wash houses are seldom ventilated so as to carry off the steam in any adequate way; the floors are often defective and not properly drained. In ironing rooms coke stoves used for heating irons give out an excessive heat, and too often the damp clothes hang over head and make the heat still more trying. Gas heated irons, unless very carefully regulated, give out noxious fumes, and altogether the atmosphere is steamy, hot, and exhausting. Hand work in laundries is now to a great extent being replaced by machinery, the washing is done by machines directed by an engineer, while in the ironing room young girls stand tending machines, the majority of which are specially heated. Steam is nearly always present in the atmosphere and makes the high temperature still more oppressive. Receiving offices usually consist of a tiny office, with a small, badly-ventilated room at the back, which is used alternately for the reception of dirty and clean clothes. Sorting dirty linen in a little stuffy room is an insanitary occupation which falls to the lot of many a woman of good education who has the charge of one of these offices. It is hardly pleasing for customers to contemplate that their clean linen is awaiting them on the same shelves on which but a few days previously garments of all shades of uncleanliness were deposited.

(C.) *Factories.*—As regards the health aspect of work in factories, using the word in the sense of a place where mechanical power is used in making things for sale, I cannot do better than quote Dr. Oliver in his article on Work and Fatigue in "Dangerous Trades." "Machinery acts with unerring uniformity. At times so simple is its mechanism that a child can almost guide it, yet how exacting are its demands. While machinery has in some senses lightened the burden of human toil, it has not diminished fatigue in man. All through the day hours of work in a factory the hum of the wheel never ceases. Requiring constant attention,

to stop the machinery is to lose money, and so men and women are obliged to wrestle with the forces of steam and mechanical ingenuity. While the machinery pursues its relentless course and is insensitive of fatigue, human beings are conscious, especially towards the end of the day, that the competition is unequal, for their muscles are becoming tired and their brains jaded. To the machine this is nothing, to the human being each hour that passes beyond a well defined limit means increasing fatigue and exhaustion." It is this unceasing "competition of sensitive human nerve and muscle against insensitive iron," to quote Dr. Oliver again, which seems to me the particular danger of work in factories as compared with workshops. When one thinks of sewing machines driven by electricity working at the rate of 4,000 stitches a minute, it is not surprising to hear that girls are afraid to work them. The nerve tension involved must be acute. In another class of factory, where women and young girls are employed as feeders, there is in addition the strain of a terrible monotony. An example of this was a cartridge factory, which I used to inspect some years ago. There a girl would stand all day in front of a machine, take a cartridge case from a basket on the left, place it under the finger of the machine which rose and fell automatically, throw it in a basket on the right; all day long standing with the whirr of the great wheels over head, the smell of machine oil pervading everything, the relentless rise and fall of the machine. What wonder if when released from this unintelligent mechanical toil the factory girl rushes out into the street with shout and loud laughter? Surely a healthy natural reaction.

(D.) *Restaurants.*—There are considerably over 6,000 women employed in City restaurants, of whom some two-thirds are waitresses, the remainder being employed in kitchens, either as cooks, vegetable maids, or washers up. Of the kitchens, more than half are situated in the basement, and this fact is responsible for the majority of the defects. The natural ventilation of a basement (if any) is obtained from fanlights under the stallboard and gratings in the pavement, and the air thus admitted is laden with dust charged with all manner of impurities from the street. Artificial light has to be used nearly all day, and is usually in the form of ordinary gas jets, adding their quota of impurities to the air, increasing the heat, and blackening walls and ceilings. In some basement kitchens electric light is used, and elaborate arrangements of electric fans and air shafts have been fitted up with excellent results. The condition of the floors is also more liable to neglect in basement kitchens, for the good reason that a defective floor in a kitchen on an upper floor would compel attention by its disastrous effects on the ceiling of the room below. In

kitchens above ground good ventilation and light are easily secured, and they are generally healthy. There is very seldom any overcrowding in kitchens. The conditions under which waitresses work require little comment. Apart from the long hours of standing, there is not much cause of complaint, and in the City, the hours, with the exception of those in early coffee houses, are considerably shorter than in the other parts of London. The tea room or dining room is as a rule cool and fairly well ventilated, and kept at a reasonable temperature. The need for providing proper dressing rooms is often overlooked, and curiously enough more often in those restaurants where smartness is expected of the waitresses: consequently the girls have to change their clothes and do their hair in the kitchen, which too is the only place where they can hang their out-door garments, generally wet and muddy, a state of things distinctly undesirable both from the waitresses' and the customers' point of view.

(E.) An increasingly large number of women are employed as clerks and typists in the City. Besides those employed in regular type-writers' offices, there are also many educated girls employed as telephone operators, and in various other capacities. The offices in which they work are often dark and badly ventilated, in some the gas is burning practically all day, and the only means of ventilation is the small ventilating plate in the window, and this is usually shut, on the plea, which is certainly justified in some busy City streets, that if the ventilator is open it is impossible to hear oneself speak. The cubic space per person is not seldom considerably less than 250 cubic feet.

There is a curious idea prevalent among the heads of these offices that there is something derogatory in the suggestion that fresh air is necessary for the health of lady clerks; one is met with the observation, "Oh, but this is not a workshop, I assure you my girl clerks are all *ladies*." It is difficult to convince them that the "daughter of a hundred earls" would in the process of breathing vitiate the air to the same extent as the humblest factory worker, and with the same harmful result to her health. More serious is the menace to health caused by the absence of suitable sanitary accommodation for the lady clerks, which obtains in the majority of these offices. This is especially the case when there are only two or three girl clerks. On each floor of these buildings there are usually four or five distinct offices, the occupiers of which have the use of a lavatory either on the same floor, or else one of a number on the top floor; and as long as there were only men in the building this accommodation was ample. The position of the women clerks who are employed at these offices is most difficult, they have practically no option but to accept the

situation and make the best of it. Their health is gradually undermined and anæmia and neurasthenia are the least evils that result, too often serious internal injury is caused, and the harm done does not end with the girls themselves. The importance of this matter cannot be overrated, hundreds of girls are employed in these offices, they come to the City from suburban homes, having at least an hour's journey; they usually begin work quite young, at about sixteen years old, and the work is trying to the nerves under the best conditions, without the added suffering, mental and physical, which such absence of sanitary accommodation entails.

Outside the Administrative County of London there is no doubt as to the legal obligation to provide separate sanitary accommodation in offices. section 22 of the Public Health Amendment Act, 1890, reads :—" Every building used as a workshop or manufactory, or where persons are employed or intended to be employed in any trade or business, whether erected before or after the adoption of this part of the Act, in any district, shall be provided with sufficient and suitable accommodation in the way of sanitary conveniences, having regard to the number of persons employed in or in attendance at such building, and also where persons of both sexes are employed or in attendance, with proper separate accommodation for persons of each sex."

Unfortunately the Public Health (London) Act, 1891, is less explicit: in section 38 the expression "building . . . . . where persons are employed . . in any trade or business" is replaced by the vague term "workplace," of which there is no definition in the Act. But in the case of Bennett *v.* Harding, 1900, 2 Q.B. 397, which was taken under section 38, Public Health (London) Act, 1891, it was held that the word "workplace" is not to be limited to places where something is being manufactured or made, but includes any "place where work is done permanently, and where people assemble together to do work permanently of some kind or other." This definition would surely include offices.

Again section 37 of the same Act enacts that if it appears to the sanitary authority that any house is without proper and sufficient sanitary accommodation "*as the circumstances may require*," they shall require the owner or occupier to provide the same.

And in section 141 the expression "house" is said to "include schools, also factories and other buildings where persons are employed."

If neither of these sections is held to apply to offices, it would seem time that by fresh legislation London should be brought into line with the rest of the country, in a matter of so vital importance to health.

Mrs. F. J. Greenwood (Finsbury) observed that, as a sanitary inspector in a district that borders on the City of London, she desired to emphasise the importance of what Miss Safford had said with regard to bringing the places where girl clerks work under the Public Health Acts. It would, perhaps, be better to bring them under the Public Health Acts than under the Factory Acts, because the Factory Acts deal not only with sanitary conditions, but also with hours of work. It was to be easily understood that many city offices would not like to be brought under the Factory Acts in that respect. But it was absolutely necessary that the places where these girl clerks and educated women are working should be made as healthful as the workshops and work-places where the working classes are engaged. She held very strong views on this subject, and would welcome any legislation that would lead to an extension of the application of the Public Health Acts in this direction.

Mr. Wells (Newcastle-on-Tyne) called attention to the necessity of an increased power of legislation in one particular direction. A serious omission had been made in the Public Health Act and cognate statutes with regard to the space in which people not only work but live, because no floor space had been specified in any of these Acts, with regard to the workshop there was given a dimension of 250 cubic feet. Now if they were to take the lecture-room in which they were meeting, and turn it into a workshop, it would be possible legally to put as many work people into it as could stand closely together on the floor, and still they would have the 250 cubic feet of air space for each. Taking the room as probably twenty-five feet high, the floor-space divided into 250 cubic portions would give a floor-space to each individual of about three-quarters of a square yard. Why the legislature would not insist upon a minimum floor-space when they insist upon a minimum cubic space was beyond anyone's comprehension. It was, for instance, a common experience of his to go into a tailor's workshop and complain of the overcrowded condition of the toilers in that workshop as they sat on the boards, and he would then be told by the employers that they were exceedingly disappointed for they had had the room increased in height on purpose to accommodate more tailors on the floor. That was under the existing law a legal thing to do.

Miss Irwin (Glasgow), from her experience in Glasgow, desired to emphasise the importance of the point mentioned by the last speaker, Mr. Wells. In an investigation made into the tailoring trade in Glasgow, a year or two ago, she had been struck by exactly the same fact with regard to workers in those workshops which had the legal amount of cubic air capacity. These places were frequently overcrowded, and the workers were most uncomfortable owing to the failure to give them adequate floor-space. This was a matter of very great importance, and it was somewhat extraordinary that such a provision should have been omitted from the Factory and Workshop Act.

Mr. H. M. Robinson (Glasgow) said there were two points in Miss Safford's paper which might be advantageously referred to. One was the heating of the workrooms and the method suggested, viz., hot water pipes. As the factory inspector in charge of that district, he had experienced considerable difficulty in carrying out the Act with regard to obtaining a proper temperature. He had found in a few instances that hot water pipes had been adopted with very considerable success. In medium or small-sized workshops water could be heated by a small gas stove placed in the fire-place. The second point was the use and abuse of gas. Improved methods would not only be advantageous to the workpeople, but economical to the employers. In all factories an enormous amount of gas was used for lighting purposes, and a great amount of bad air and waste was caused by using common burners. If they would only use better means of lighting the rooms by gas, there would be considerable benefit in healthy conditions and an increase in light. Not very long ago he came across a warehouse in connection with a paper mill, in which there were fifty-six gas-burners of the ordinary common type. The firm afterwards introduced incandescent gas-lighting, and now had only eighteen burners giving a splendid light, and resulting in a greatly improved condition of the atmosphere in the room. These two points might be remembered with advantage.

Mr. W. Dyson (Kettering), though not a medical officer or a sanitary inspector, came from a large boot manufacturing district, having been connected with the trade for thirty or forty years. In connection with that trade there was one point to which he should like to draw the attention of factory inspectors, medical officers of health, and sanitary inspectors, though he doubted whether it was a matter which came within the scope of the Factory Acts. In the rivetting departments a great number of females were employed making up children's boots and shoes, on which a large quantity of rivets, nails or tacks was used. Now, very little had been said about spitting on the floors of factories—but the point he desired to mention seemed almost worse than spitting on the floors. The work-people stood at long benches facing each other, and the rivets or tacks were all put into the mouth and used from the mouth. In the boot-making industry nearly everything was used from the mouth. The boots were all lasted from the mouth. The tacks were taken from the mouth, were put back and used again in the same way by all the workers, so that the tacks would pass in this way from mouth to mouth over and over again. This was surely a reprehensible practice, which obtained in all boot-making districts, but it could not be brought under the Factory Act. He thought that perhaps medical officers of health might do something in the matter. It was a disgusting practice, and while it obtained it seemed to be useless to put notices in the factories against spitting on the floors. Very few sanitarians seemed to

be aware of this particular labour condition. There was another question to which attention might well be called, and that was protection against fire. It was the practice in shoe factories to lock the doors during certain times of the day in hundreds of factories throughout the country, say from half-past seven to eight, when there was just as likely to be a fire or an explosion as at any other time. If the inspectors would visit the factories at that hour, instead of always in the middle of the day, they would find hundreds of doors locked and the people closed in. In case of fire the consequence might be very dreadful.

COUNCILLOR W. F. ANDERSON, J.P. (Glasgow) supported the suggestion of Mrs. Greenwood with regard to an extension of the Public Health Acts, in the direction indicated. It seemed a preposterous thing that a factory inspector who had got to deal with factories should have no right to go where a large number of clerks are employed. The omission seemed unintelligible. But from an administrative point of view, it was no use spoiling things by a dual administration, and such a thing as that might well be in the hands of the local inspector. He did not object to the government inspector acting as a supervisor; if the sanitary authority did not take samples of food, the government could take them for the local authority. The government inspectors or officials might be the supervisors of the local administration. In Glasgow they were very fortunate in their factory inspector, but it would only spoil the work to have the work of inspection in kindred matters split up between different sections of inspectors. Mrs. Greenwood, for instance, might well control, not only workrooms, but other places where lady clerks are employed. The proper administration of the Act ought to be placed in the hands of the local inspector, with proper supervisory inspection from the Home Office.

THE EFFECTS ON HEALTH OF WOMEN'S EMPLOYMENT IN SHOPS.

Miss MARGARET G. BONDFIELD.

I AM not able to treat this subject from the standpoint of the scientific or medical expert, but it is in the hope that the observations of a practical worker in the distributive trade may not be without value, that I submit this paper.

In considering the effect on health of women's employment in shops, it is necessary to take into account the hours, wages, the "living in" system, the nature of the work, and the atmosphere of the place in which the work is done.

With regard to hours, employment in shops may be divided, roughly, into three classes; in the first class are the shops nominally closing in the evenings at 6.30 to 7 p.m., and on Saturdays at 2 p.m., averaging an actual working week of from 63 to 68 hours; in the second class of shops the nominal hours extend to 8 or 8.30 p.m. for four nights, one day closing at 2 or 4 p.m., and one night at 9 or 10 p.m., averaging an actual working week of 69 to 74 hours; in the third class, the closing hour may be any time from 8.30 to 9.30 on three nights, there may or may not be an early closing day at 2 or 5 p.m.; there certainly will be one or two nights when the shops are open till 11 or 12 p.m., and the working week extends from 75 to 85 hours. Among this class of shops, Sunday trading is on the increase.

In the distributive trade no classification of wages is possible at present, and it is difficult to get reliable information even of individual cases, as the assistants observe great secrecy, failing to recognise that this foolish reserve helps to keep down wages. In addition the method of paying wages is most unsatisfactory, viz., partly in wages contracted for, partly in premiums or commission, and partly in truck (i.e., the living-in system, by which employers provide board and lodging). To add to the confusion, many employers keep 10 to 14 days' wages in hand. For these reasons, assistants are unable to state the actual amount of earnings for any given period.

From my personal experience and observation I am convinced that for

the average women assistants the total nominal earnings from the three sources do not amount to more than 2½d. to 3½d. per hour, and when, as is frequently the case, assistants have to buy food to supplement that provided by the employer, the actual earnings are depreciated to the extent of from 1s. to 5s. per week.

The quantity and quality of the food provided by the firm depends largely upon the ability and goodwill of the steward or housekeeper. I am reminded of two houses where, in each case, the amount allowed by the firm for the cost of boarding and lodging the employees was 6s. per head per week. In one house, the food was certainly monotonous, but good, well cooked, and nicely served; the assistants ate their meals heartily, and only spent from 6d. to 1s. 6d. per week in "extras" for breakfast and supper.

In the other house the food was neither good nor well cooked; assistants frequently left the dinner untouched, and it was necessary to spend from 3s. to 5s. per week of their own money to satisfy hunger.

The following is a menu for the week in an average business house in East London, where the cost to the employer of boarding and lodging the employees is estimated at 4s. per head per week.

BREAKFAST.

Bread and butter or dripping, tea or coffee.

DINNER.

Monday ..	Hot roast mutton, potatoes	bread, ale, water.
Tuesday ..	Cold roast beef, potatoes, currant pudding	
Wednesday	Stew	
Thursday ..	Cold salt beef, potatoes	
Friday	Hot roast beef, potatoes, boiled pudding	
Saturday ..	Cold roast beef, potatoes, bread and butter pudding.	

TEA.

Bread and butter, tea.

SUPPER.

Bread, cheese, butter, and, twice each week, fried or baked pudding, ale, water.

Apart from its demoralising effect on wages, the living-in system has many disadvantages which well-meaning people, who believe it provides a home where the young people are guarded from evil, fail to take into account. Assistants living-in are frequently many miles from home, and dismissal means also immediate loss of shelter; they have very little cash in hand when settling-up day comes, certainly not enough to keep them in lodgings for any length of time; and yet, to go home, if they have

sufficient money to take them there, is to go probably to some country district, where they will have great difficulty in getting situations.

The thought of dismissal brings with it a terror which the poorest worker, who owns a shelter independently of her employer, knows not at all.

The sleeping rooms, from the hygienic standpoint, are sadly deficient. The air space varies from 500 to 700 cubic feet per person, but the fireplaces are invariably blocked, the windows at night are either closed entirely or opened only an inch or so, and there is no other kind of ventilation.

The atmosphere of such rooms by morning can be better imagined than described.

The washing accommodation is very limited, and there is no privacy in the bed-rooms. Except in the best houses, no bath-room is provided, and the assistants, too frequently, are content with a weekly washdown in a small hand basin, the daily ablutions being confined to face, neck, and hands.

In the matter of clothing there is great need for reform. The regulation dress of the shop assistant must be black (a most unserviceable colour) it must also be stylish. The skirt usually sweeps the floor, the under garments afford no proper covering for the chest, the "fitting" corset does its deadly work in preventing the proper expansion of the lungs, and the thin, cheap shoes afford no protection to the feet but rather aggravate the soreness and inflammation caused by dust, standing and lack of opportunity to properly bathe them.

The use of the bed rooms during business hours is forbidden, except by permission of the shop walker. It is easy to understand that women hesitate to ask for this permit from men, and the regulation frequently causes acute physical discomfort.

The day's work begins with the "squadding party" from 7.30 to 8 a.m. Breakfast, 8 to 8.25. From 8.30 to 10.50 the main business is "dressing out" (*i.e.*, displaying the goods on lines in cases, etc.) and arranging stock; with occasional interruptions to serve customers. In the busy season there will be parcels left over from the previous day to pack and dispatch, special orders to book, etc.

Ten minutes is usually allowed for washing hands; then, from 11 a.m. till closing time, the main business is serving customers.

There are intervals of from 30 to 45 minutes for dinner, and from 20 to 30 minutes for tea; the meals are hastily served and hurriedly eaten, amid much clatter and confusion, in the dining room on the

business premises. No rest, not even a walk in the fresh air, is possible in these brief meal-times.

The nature of the work is varied; in some departments the actual physical strain of lifting heavy stock boxes from fixture to counter and back, is very great; in others, the physical strain is slight, but the goods are easily damaged and necessitate exhausting care and patience in handling. Some goods, when turned over, throw off irritating particles, others emit an unpleasant smell especially noticeable in cheap, dyed stuffs.

But without taking into account special strain in particular departments, I think it is not sufficiently understood that the nature of the work in connection with serving customers is irritating and fatiguing to the last degree, and although the physical strain is undoubtedly greater in the lower-class shops, yet the customers are more easily served; while in the West End trade, where the hours are comparatively reasonable, the nerve strain is so great that the assistants are equally exhausted at the end of their shorter working day.

Towards evening, in every grade, the atmosphere of the shop becomes thick with dust raised by the continual tramp of feet and trailing skirts, to which is added the fine particles detached from the goods that are being continually tossed about.

In the late-closing shops the atmospheric evil is intensified by the fumes of many gas jets.

Sir James Crichton-Browne, at the Sanitary Institute Congress of 1902, read a paper on "The Dust Problem," in which he dealt with the evils of "Industrial Dust." I venture to assert that it would be difficult to find a trade in which industrial dust plays such havoc with the health of the workers as it does in the distributive trade.

For proof of this, and with the assistance of my doctor, I have analysed and classified the medical certificates received during 1903 at the Central Office of the Union with which I am connected.

The claimants live in all parts of the country, and from the fact that they have paid regularly to a Benefit Society it is fair to assume that they are in steady employment.

I am unable to classify them in groups of ages, but the majority are between 20 and 30 years of age.

We know that the majority of those who join our Union are assistants from the first class of shops, where hours of labour are comparatively reasonable; it is therefore fair to assume that the 1,280 assistants who received sick benefit were not working under the worst conditions that

obtain in the trade. The result of my analysis, as shown in the following table, is startling in its significance:—

Analysis of medical certificates of claimants on the Sick Benefit Fund of the National Amalgamated Union of Shop Assistants, etc., during the year 1903.

Complaints Classified.	Number of Cases.		Percentage of Total.	
	Men.	Women.	Men.	Women.
Anæmia and Debility	97	65	9·32	27·08
Digestive Diseases	240	55	23·07	22·91
Respiratory ,,	501	91	48·17	37·91
Surgical ,,	153	24	14·71	10·00
Zymotic ,,	49	5	4·71	2·08
TOTAL CASES	1,040	240		

In dangerous trades, in mines, on railways, etc., it is easy to get statistics of injury to the workers directly attributable to the employment. In the distributive trade, health statistics are difficult to obtain; but those of us who are in direct touch with this class of workers know that the nature of the employment, and the conditions under which they work, are slowly but surely draining the vitality and stamina of a very large number of *young* people who enter the trade healthy and strong.

Sir William MacCormac, giving evidence before the Lords' Committee, on the Early Closing of Shops, said: "There is no doubt, I think, in my mind that such long hours must contribute to the incidence of disease; that it must lower the general vitality of persons so engaged, and render them more liable than they otherwise would be to attacks of different forms of disease, and most especially on account of the long hours at night which such a period during the week entails. These hours, too, for the most part are worked in an atmosphere very prejudicial to health . . . . I quite agree with the opinions of my predecessors that such long hours are very grievous and are calculated to do the community in which they largely prevail serious harm. . . . It must have an influence on their offspring undoubtedly. . . . . In one sense it cannot be said to be urgent, but it is insidious; it is gradual and progressive in its effect, and it goes on, I am afraid, in a cumulative degree."

Sir William Church, who gave evidence the same day, said: " . . the evil is not merely the presence in the shop: it is the absence of opportunities of getting fresh air and meals . . . . They fall into two great classes. There is one form of ailment which is aggravated by work such as shop assistants have to do. Those come rather under the observations of surgeons and physicians who practise more especially in diseases of women. But there is another great group which falls under the observation of the ordinary physician and of which we see a very great deal in our London hospitals, and that is anæmic condition which is produced partly by long hours of work, and still more so by the confinement that this employment entails. They do not get sufficient opportunity for being in the fresh air and in the sunlight, and the evil is, of course, greatly aggravated by late hours at night."

Many other medical experts have given evidence to the same effect, emphasising the fact that the effect on health of employment in shops is injurious for *men* and still more so for women; that the evil is so grave as to be a matter of national importance.

Concerning clothing, personal cleanliness, and fresh air in the sleeping rooms, the assistants could do much to improve matters, and there is hope that the importance of teaching hygiene and the meaning of personal cleanliness in our elementary schools will be realised soon enough to have a marked effect on the rising generation of workers; but to cure the graver evils of long hours of labour in a vitiated atmosphere, requires organised effort on the part of the workers concerned, aided by practical legislation to limit the hours worked in shops.

Councillor W. F. Anderson, J.P. (Glasgow), as one who was born a shopkeeper, and who had experience of the questions raised in the paper, said the proposition in the paper of Miss Bondfield was altogether impracticable. If the hours of employment were too long they should be shortened by voluntary effort. He thought that Miss Bondfield was injuring her own cause in trying to discountenance the efforts that have been made by such philanthropists as Lord Avebury during the last 20 years. Lord Avebury had been directing attention and also the attention of Parliament to dangerously long hours worked in shops, and had now persuaded Parliament that something must be done, and a Bill had been introduced. The history of Parliament showed that the legislature went a good deal slower than many people liked. The class of people who wanted to be helped most was that class which worked anything from 66 to 84 hours per week. In Glasgow there was a large class of such workers, their hours running up even to 90 per week. It was doubtless a shame, and the first effort

should be made in that direction, and the first effort was a Bill limiting the hours of labour of young persons under 18 of both sexes. That had been in the administration of the health department in Glasgow, and a great many prosecutions had taken place. Now Parliament had gone further, and had introduced a Bill which had passed the second reading, giving each local trade the power to shut not earlier than 7 o'clock in the evening, if they want to close. What were the facts? It was not a matter of 30 or 33 per cent., but he contended that the cause of late hours in every district, all over the land, was caused by not more than 5 per cent. of a particular trade, who would not close earlier, and those 5 per cent. were generally the hot-headed agitators when he was an assistant. But he desired to be practical, and would suggest that it was a very big step to take to reduce the hours from say 84 to 60. He thought they should accept the instalment which had been offered them by the Bill, and so far as Glasgow was concerned, they would support it. They had requisitions signed by thousands of people, and they wanted at least to take advantage of the half loaf, so that the shop keepers might have some opportunities of doing something else besides pay rates which were out of all proportion to their incomes, and to enable them to enjoy the parks and museums and galleries that had been provided for the public. But in this matter reformers must be practical, and he therefore asked the conference to accept as an instalment the present proposition, which was that two-thirds of any particular trade in any particular district had only to go to the local authority, and then the local authority would issue an order which would be absolutely binding. But for any person to talk about the suggested cast-iron measure for Glasgow was preposterous. Those who talked so did not know the city. What would govern Buchanan Street would not apply to other streets, and they could not have the tailor put on the same level as a grocer's shop.

Mr. James Macpherson (London) took it that the object of the legislation proposed by the Government Bill was to reduce the hours of those employed in shops. When a similar Bill was before the House of Lords, that champion of the freedom of the worker, Earl Wemyss, said the Bill of Lord Avebury, which was practically the same as the Government Bill, would give permission to prevent a full-grown man from working. Lord Avebury got up in the House of Lords and said that there was not a word in that Bill from b-ginning to end which would prevent the employer working his assistants as long as he liked. Now that was the kind of legislation that Councillor Anderson was supporting.

Councillor Anderson: No, sir.

Mr. Macpherson said that measure was not worth anything, because in many shops in Glasgow, Manchester, and Liverpool there was a large amount of work done after the shop was closed. They might go into some of the finest streets in London and see the shops closed from 6 to 8 o'clock in the evening,

but in those shops thousands of assistants were working up to 11 or 12 o'clock at night, and Lord Avebury's Bill would not do anything to stop it.

Miss Nora Vynne (London) expressed agreement with the view of Bailie Anderson, and pointed out that the real meaning of Lord Wemyss was that Lord Avebury's Bill would prevent the costermonger selling herrings on his barrow any later than Marshall and Snelgrove sold silks or satins.

Miss M. Bondfield, in reply, suggested that the general feeling was in favour of her proposals, and that the legislation to which Bailie Anderson referred—the only legislation on the Statute—did go in the direction of limiting the hours of labour. The legislation referred to affected the employment of young persons, and limited the hours to 74 per week; that in itself was an indictment of the whole system of the distributive trade. Bailie Anderson asked if it were not a big step for the Government to introduce this Bill. She would reply "No; certainly not." The Government, owing to pressure in favour of a much more drastic measure from all parts of the country, were compelled to bring forward something, and so they brought forward the most inadequate and incapable Bill they could bring forward. Bailie Anderson said that if the Government Bill were passed it would limit the hours of young people from 84 to 60 hours per week. She maintained, with Mr. Macpherson, that the Bill would do nothing of the kind. She doubted very much if any district outside those districts where already the employers had early closing, because they took an intelligent view of the situation, the Bill could possibly be put into operation. In the first place, they had to get the two-thirds to sign the requisition, and in the second place, butchers, bakers, candlestick makers, and any small section of traders, would have to go to the local authority; the local authority must refer to the central authority, who may institute a local enquiry. At each stage there could be a check or delay, and the cost of putting the Bill into operation would be enormous. And then when it was in operation, and assuming it applied to a section of the trade or a section of the area, could anyone imagine that a measure of that description could possibly be regarded as satisfactory? She was rather inclined to think that Bailie Anderson had read into the Bill what he wanted to see there and that he did not understand the actual proposal. That was the position of a great many employers in this country who would like to see early closing and a limitation of the hours of work, and they could not imagine that any Government would be so utterly ridiculous as this Government appeared to be able to be as to pass a measure which will not really do what it sets out to do, and that is to limit the hours of labour in shops. There was nothing in the Bill from beginning to end which would prevent an employer doing as he does at present—working the assistants after the shutters are down; but her contention also was that the Bill would not even get down the shutters in those districts where the reform of earlier closing was most needed.

WOMAN'S HOMEWORK IN RELATION TO COMFORT, CHARACTER, AND HEALTH.

By Miss NORA VYNNE.

ABSTRACT.*

AMONG the homeworkers the person so often slightingly alluded to as "that inevitable poor widow," *i.e.*, the woman who is the necessary bread-winner of the family, is the rule and by no means the exception. In some eighteen places visited, and from the evidence taken from over 1,000 women, very few cases were found of women working from any other reason than absolute necessity.

The following towns were visited:—Liverpool, Manchester, Leeds, Sheffield, Cradley, Cradley Heath and Old Mill, Nottingham, Leicester, Yeovil, Earls Barton, Luton, and various villages and townships in Oxford, Somerset, and Buckinghamshire.

The trades investigated included:—Tailoring, glove-making, woollen gloves and hosiery, file-cutting, nail and chain-making, lace-making, shoe-making, and straw-plaiting.

The method followed was to call at houses, and afterwards to invite workers to a meeting. No statements made by individuals are quoted, or in any way utilised, which were not put to the public meetings and confirmed.

Two extremely important points were urged by every woman visited, and by the unanimous voice of every meeting.

When work is not sweated, it was declared emphatically that the rate of pay was invariably the same for home-work and factory-work of the same class. When the amount earned was smaller than is earned in a factory, it is (*a*) because the workers find it pays them better not to work full time; (*b*) because the less skilled work is put out and the better paid done in the factory; (*c*) because the work is sweated, *i.e.*, not given to the women direct.

"Sweating," where it exists, is due to separate and preventable causes, and is by no means a necessary consequence of home-work. In towns or

* The facts upon which the paper was based will be found in "The Report of the Inquiry into the Conditions of Homework in the Provinces," issued by the Freedom of Labour Defence, 48, Buckingham Palace Road, London, S.W.

villages where the outside causes did not directly tend to foster sweating, I found no trace of it.

The sanitary authorities in every town visited testified that, taking the average, home-workers maintained a much higher standard of cleanliness and comfort in their homes than factory-workers, or even women who did not work at all as bread-winners.

It was a curious comment on the theory that the home-worker is a careless housewife, that a meeting having been held, at a time conflicting with the men's tea hour, all the married women present left in the middle of the meeting to "get their husbands' tea ready," leaving, however, expressions of sympathy and their desire to support the object of the meeting, with their unmarried friends.

TAILORING IN LEEDS AND WINTERBOURNE.

The tailoring trade shows home-work at its worst and at its best. These conditions are governed by causes entirely separate from the nature of the work itself.

Tailoring in Bristol was seen at its best. The majority of workers lived outside the town in healthy villages, the work being sent out to them in carts. There were no complaints of sweating. In Leeds it was less satisfactory, as the local system of house letting gives great facilities for sweating; in Manchester and Liverpool there were fewer complaints of sweating, but many of bad trade and over competition.

Glove making in Yeovil and the surrounding villages was proved to be an exceptionally prosperous and pleasant calling. In the Oxfordshire villages it was less prosperous, but the women declared that they would be much worse off without it. The woollen glove and hosiery work in Leicester, and lace work in Nottingham, are for the most part so easy that it takes next to no learning; anyone can do it. The pay is therefore small. Old people can, however, keep themselves out of the workhouse by it; the skilled labour is, however, better paid. In the shoe trade at Nottingham only the cheaper kinds of work are given out. The straw plaiting at Luton only occupies a few months out of the year. The greater part of the straw is prepared in Japan, and finished and made up into hats in England.

Summary of reasons given for preferring home-work to factory work:—

1. It is more profitable. "One shilling earned at home is worth three earned in a factory." "What you earn at home you earn for yourself; what you earn in a factory you've got to pay away."

Many women declared, "If we go to a factory we should have to pay

some one else to do our washing. We'd have to pay some one to do our shopping, and then it would not be done as well as if we did it ourselves." "We don't want to lock the children out in the streets, as some do, while we are at the factory." "We must either do that or pay 3s. 6d. each a week to have them taken care of."

This part statement seemed so startling that I should scarcely venture to quote it had it not been confirmed at a large meeting, and afterwards at meetings at Liverpool, Manchester, and Bristol.

2. "You can look after your children, give them their meals comfortably, see they get to school in time, and keep them out of the streets. It does not expose the young girls to the temptations of factory life."

3. "It is less wearing to the health; you can stop when you want rest; you needn't get up at a fixed hour every morning, or be out in all weathers."

4. "If you work at home you can teach your children a trade, and that saves the expense of apprenticing them."

5. "I couldn't stand the roughness and coarseness of factory life." (Many Leeds, Manchester, Liverpool, and Leicester hosiery workers, &c.)

6. "I couldn't stand the noise of a factory." (Very many women in various trades.)

7. "I'm too old to get taken in a factory, but I can keep myself at home." (Very many women in various trades.)

8. "It don't take me long to clean my house, and when I have done my housework and cleaned myself, why shouldn't I sit down to my fancy-work like a lady?" (A Sheffield burnisher.)

9. "No, I don't need it; my husband's in work, but my mother's paralysed and she lives with us, and I don't wish my mother to be a burden on my husband." (A Leeds tailoress.)

10. "Even if you have a good husband, you've a right to help him to get on." "One shilling of your own earnings is worth three of your husband's." "Your husband thinks more of you when you're a bit independent of him." (Nail and chain makers.)

11. "Yes, my husband's in work now, but he was out of work ten weeks last year, and I do a little work to keep my name on the books, so that another time if I really want work I can get it." (Leeds tailoress.)

The point to be noted in the above reasons is the shrinking of so many women from strain and hurry, from the anxiety of early train catching and the exposure to weather, the choice between running lest the door be shut and waiting in the wet till it be opened; the difference between working up to some one else's standard of speed, lest dismissal in favour

of a quicker worker should result, and working according to your own strength; and, worse than all, the shrinking from noise.

Homework as homework has many advantages and no disadvantages, except that when outside causes give him special facilities, the sweater can directly fasten himself on the individual homeworker, whereas he can only lower the general rate of factory payments; but it is obvious that the remedy for this is to attack the sweater, not the homeworker.

[*For Discussion on this Paper, see page 751.*]

A BILL TO REGULATE HOMEWORK.

By Miss CLEMENTINA BLACK,
Vice-President of the Women's Industrial Council, London.

ABSTRACT.

A BILL for the regulation of homework has been drawn up, after careful investigation and consideration, by the Legal Committee of the Women's Industrial Council (London), in conjunction with the Glasgow Council for Women's Trades.

The provisions of the Bill apply equally to male and to female workers at home.

It does not aim at the abolition of homework, but at the suppression of certain evil conditions sometimes—by women, always—associated with homework.

It would prohibit the carrying on of any process of manufacture in dwelling-rooms that fall below a certain standard of cleanliness and airiness, as the law already prohibits such processes in insanitary factories.

The method proposed is to issue a certificate or licence, without the production of which by the worker, it shall be unlawful for an employer to give out work to be done off his own premises. The certificate to be applied for by the worker, issued by the Inspector of Factories, and to authorise its holder to take work for execution upon specified and duly inspected premises. Provision is made for the issue of interim licences pending inspection. Each certificate to be of specified duration, and renewable.

A similar system exists in some parts of the United States, and is declared to work easily and satisfactorily; the principle of requiring a licence or certificate in some cases was urged in the Report of the Royal Commission on Labour, 1894.

No burden is laid upon the employer, who merely has to see the certificate before handing over work.

The worker has to apply for the certificate, but, in return, he retains it. It cannot be withheld by an employer, and can be used to take work from as many different employers as the holder chooses.

The factory department has been chosen as the inspecting authority, rather than the local sanitary officials, for three reasons:

1. Because the central department is more independent of local influences.

2. Because uniformity of standard would thus be secured.

3. Because the cost of such inspection—which is a matter of general public concern—should not fall upon local rates.

The first effect of such regulation would be to diminish casual homework and to increase regular homework. The improvident or inconsiderate employer could no longer meet a "rush" of work by sending it to be done in any place, suitable or unsuitable—the power of doing which tempts him to omit making proper preparation, and exposes the home worker to be alternately overworked and unemployed. The employer of homeworkers' will be compelled—as the master of a factory has been compelled—to regularise and organise his business. Whatever proportion of casual workers the trade really needs will be turned into regular workers. The surplus would cease, indeed, to find that semblance of employment which now helps to keep them alive; but their hard case should not blind us to the fact that every individual drawn from the ranks of casual labour and drafted into those of regular labour is a gain to the country at large. The most difficult part of the problem of the unemployed is the existence of the half-employed, the casual workers; and one merit of this Bill is that it would diminish this class.

There is no reason to suppose that regulation would diminish employment. Experience shows that humane and intelligent regulation of conditions of labour are followed not by restriction but by expansion of trade. On the one hand, the physical and mental standard of the workers improves, and with these their productivity; on the other hand, a premium is put on the capacity and adaptability of employers, to the great advantage of the country at large. A glance at the condition of English cotton workers as they were before the law regulated their work, and as

they are now—the most stringently regulated of any workers—will illustrate this truth.

The homeworker has been left outside the pale of these regulations; and the poorest of homeworkers are in hardly a better condition than were the miners and cotton spinners in the earlier part of the nineteenth century. The evil of child labour is rampant in the worst-paid sections of homework. That evil would not be directly touched by this Bill, but would certainly be indirectly affected. The mere fact of inspection would tend to prevent the employment of children who ought to be at school. Moreover, the employment of children is lessened by everything that improves conditions of life, as this Bill would do.

Hours of labour would not be directly regulated by this Bill, although the hours of many homeworkers are admittedly far too long. But, on the one hand, effective regulation of hours of homework is almost impossible, and, on the other hand, regulation is far less necessary than in the case of factory work, because the pressure of work in common (which in practice means uniformity of hours) scarcely touches the homeworker. He works too long, not because he cannot cease till an appointed time, but because his pay is so small and so uncertain; if his work were regular and his pay adequate, he would work, as well-paid artisans do, eight, or at the outside ten, hours a day. Unlike the factory worker, he can—except for his poverty—fix his own hours, and this, not because of the law, but from the nature of things.

That the poorer homeworker's state should be brought up to that of the factory worker is the aim of this Bill; which, at the same time, would preserve the public from the dangers attending manufacture carried on in dirty or infected places.

[*This Discussion applies also to the Paper by* MISS NORA VYNNE.]

MISS BONDFIELD (London) said she entirely endorsed the conclusion in Miss Vynne's paper, so far as it went, as to the disadvantage of the sweater directly fastening himself on the home worker. But there was not only that disadvantage but a great many other disadvantages in the competition of the home worker which it was necessary should not be lost sight of, and she agreed that we want to attack the sweater, and not the home worker. But none of those who wanted to see the home work better regulated had attacked the home worker as an individual. That was a wrong feeling. But what they did feel was that the home worker required to be protected

against the economic necessities surrounding her, and to have all help from the State to make the conditions as good as possible for the home worker, and also to abolish entirely the sweated industries at present existing. The sweated industries not only affect the home worker concerned, but also affect the whole community, because, as had been pointed out, they disseminate disease all over the place. She differed from Miss Vynne as to the life of the village girl. She had been in Somerset, and those who knew the county well knew the tremendous difficulty they had as regards immorality in the villages, and they did not know what to do with the village girls. She agreed with some of the remarks as to the glove industry, which was the particular home industry of Somersetshire, that the conditions now are very different from what they were twenty-five years back, but the conditions under which the home work was done even now did not compare with the conditions obtaining at the glove factory at Yeovil. With regard to the reasons which women give for preferring home work one was inclined to agree that probably they would all be applicable to individual instances. She did not think one could safely generalise upon any one instance. Her experience of the home worker in the sweated dens of East London was *not* that they wanted to do fancy work "like any other lady." It seemed to her that when one saw little children turned out into the gutters, because their mothers have to do match-box making, or other home work, from six o'clock or even earlier in the morning till late at night, with no time to feed their children or train them; that while those reasons might be perfectly right for some districts and for some occupations, they could not be generally applicable; at any rate not to the home workers with whom they were most concerned—the home workers in the sweated industries in the large towns.

Mrs. Mason said there was one objection to home work which might usefully be emphasised at that conference, and that was the increased risk of infection. The case of measles, which was not known until it got a grip of the child, was in its early stages most infectious. A child would contract measles before one was aware of it, and speaking not at all offensively, was not that a condition which created a risk in regard to home work. Was not that really a strong and valid objection, if there was any objection to home work? One remark was made as to a woman being able to sit down when she liked if she had her work at home. But this was not so, as seen in the little experience which she had had in the matter. One woman, who had a large family, had told her, that for some weeks she would have little home-work at all, and then in other weeks she would have a lot of work which had to be done at once, even if she had to sit up all through the night to do it, without any time to rest. This woman worked to keep her home together, because her husband had been an invalid for several years. This was certainly not taking up fancy work, like a lady.

MISS IRWIN (Glasgow), said she had listened with astonishment to the coloured picture which Miss Vynne had given them that morning of the home worker. It had been her duty to investigate some 20 home work trades in Glasgow and elsewhere, and she had to say emphatically that her experience did not coincide with that of the author of the paper. Of course, there was no objection to the claim put forward on behalf of the class of worker who kept her house in a cleanly and generally sanitary condition. But there was a seamy side to the subject, and she could appeal to the medical profession as to whether the many dirty and insanitary homes in which the making of clothing, etc., was carried on, were not a great menace to the public health. They had no wish to restrict the industrious decent home worker, or housekeeper. It was the insanitary casual person, who kept her home in a disgraceful state, who used the shirts and other garments given to her for work, as bed-clothes for sick children, as she had found to be the case over and over again to whom exception was taken. The public had some right to be protected against such. As Miss Black was not present to read her paper, she might be allowed to say a word in regard to the Bill to regulate home work. As secretary of one of the two societies responsible for the promotion of this Bill, she was most anxious to remove misunderstanding regarding it. The measure did not aim at abolishing home work, it aimed at abolishing dirt. All that they asked in the Bill was that any woman taking work in to be done at home, should be provided with a certificate by the factory inspector, saying that her house was in a reasonably sanitary condition. This seemed to be an absolutely necessary safeguard for the public health. The well-doing, decent class of home worker would be left as she is to-day. In fact, her position would be rather improved, because she would be registered, and thus have her status raised and strengthened. Whereas the insanitary casual home worker would have to mend her ways. She did not think that the circumstances, however necessitous, of any home worker could constitute a claim to keep a fever den at the public risk. The fancy work spoken of by Miss Vynne as investigated by herself, consisted chiefly of finishing shirts. These were paid for at something like 2½d. per dozen, each dozen taking two hours to finish, and the worker having to supply her own thread. She knew one case of a trouser finisher, a woman, who finished trousers at ½d. per pair, had to supply her own thread. The work took an hour and an half, and finally the woman gave it up, saying it was easier to starve without the work. It was the insanitary conditions of home work which the Bill aimed at remedying. These did not admit of any countenance at all, being so obviously a danger to public health as not to require discussion.

COUNCILLOR SMITH (Birmingham) pointed out that there were certain trades in Birmingham which could not very well be done at home. For instance, valuable articles could not be given out at the factories which women are required

to polish. He did not think any manufacturer would hand to his employees valuable articles to be taken home to be polished. Nor could such articles as pins and needles be taken home to be made.

Mr. W. Dyson (Kettering U.D.C.), said there was a good deal of home work attached to the trade of his district, boot and shoe making. It was certainly unpleasant for a man to return home and find his house filled with boots and shoes, but the worst feature attached to this home work in cases was the amount of child labour it involved. He knew for a fact that in Kettering hundreds of children, before they went to school in the morning, had to carry large bundles of boots to the factory and bring another bundle home, weighing perhaps 25 to 30 lbs.; and then after school they were sent out again. This home work in that way entailed an amount of child labour which he considered a great curse in that particular district.

Dr. A. K. Chalmers (Glasgow) reminded the Conference of one significant fact, and that was that Japan was a country of home labour. There they had conditions of home industry, and he did not think that anyone at that moment was prepared to contend that Japan was not a vigorous nation. So that obviously there was more in the simple question of home industry than was at first apparent. With regard to the question of infection, which had been referred to by one speaker, he would remind the Conference that, to a certain extent, there was already legislation dealing with infection in the houses of home workers. The precise extent to which the infection of Tuberculosis existed might be unknown, and one did not wish to strain the argument, although, undoubtedly, the risk existed, and was already before the Legislature. But there was another point which might have attention: in Glasgow there was a standard of 400 cubic feet per individual; a man in a lodging-house was entitled to that; a man living in a house of smaller size was entitled to that space for living or sleeping. But no greater provision was required though the apartments were used for living, working and sleeping. Why should it be possible for the space originally provided for living purposes to be used also for purposes of work? They had had it mentioned over and over again that in the cases referred to the space occupied for sleeping was also occupied during the day for ordinary purposes and also for the purposes of industry. That seemed to him a point closely deserving of attention by sanitarians; especially in connection with home industries.

Councillor R. Ramsay (Glasgow) observed that his experience, gained in visiting the homes of many poor people in the city of Glasgow, led him very cordially to endorse everything that had been said, and said so well, by Miss Irwin and Dr. Chalmers. He was, in fact, surprised at there being any diversity of opinion on this important subject. There was no one, however poor, on whom this measure or this Bill would press heavily; on the contrary, the very

people whom they wanted to help could quite well come up to the standard required, and he was sure they would all be most anxious to do so. Moreover, in doing it they would be preventing any serious infection to those brought in contact with them. He had often found that girls said they were ready to take anything for a little permanent work at home, and his invariable reply to such applicants was, that he would be delighted to do all he could to secure work for them if they would insist on being paid the same remuneration as was commanded by the regular worker, in order that there might not be any undue competition.

Mr. A. Ballantyne (Glasgow) referred to what Miss Vynne had said regarding those persons who had a desire to be kept on the books of the factory. To his mind those very persons were the curse of the whole system. They wanted to be kept on the books, and for that reason would take work at any price, in fact, do it practically for nothing. They did this not in order to subsist, but in order to supplement some other income, and the result was that the honest worker was told that there was some one who would do the work for so and so, and they either had to do it at the same price, or could not get any work at all. The same thing happened to the regular factory hands, who were told that so many hundred dozen were taken out at such a price the night before, and they must do the work for the same sum or the factory would be shut. So prices were lowered all round. Miss Vynne had suggested that the rate paid for certain work was the same outside the factory as inside the factory, and that the standard was for casual work and not for factory work. But the figures had been going down all the time he had been connected with the home-work question, and that was for a considerable period now. He should urge most strongly the passage of such a Bill as that suggested by Miss Clementina Black, for it was a Bill that would not put the good home worker out of existence, and it would do for them what industrial legislation has been brought in to do for other workers and the employers, and bring them up to the standard of the best that is in the trade. There were out-workers' homes to which no one could object, and the Bill would not interfere with them. But what astonished him most was that people should object to provisions which he thought everyone was agreed upon—the necessity for cleanliness where work was being done upon articles which were to be worn by other people. He had, in the course of his work, found awful conditions; someone had attempted to describe them that morning. Not only in fever houses, but work was actually done in places where there were also housed cattle, sheep, and horses, and also poultry. These were the conditions which they aimed at remedying, and bringing about such conditions as those dwelt upon in the rosy picture given by Miss Vynne.

Mr. Ambrose (Glasgow) accentuated what had been said by Mr. Ballantyne, and observed, with regard to the suggestion thrown out about the out-workers

of Japan, that there was no regard with respect to infection in Japan, where the death-rate from smallpox was enormous, far beyond what it was in this country, and that notwithstanding the fact that in Japan they have compulsory re-vaccination.

Miss Nora Vynne, in reply, said she had been careful to refrain from touching on the political aspect of the various questions involved; but from remarks passed about the Bill it almost looked as if the poorest workers were to be penalised for the benefit of those left. The reason why the Home Workers League liked the visit of the sanitary inspector better than the visit of the factory inspector was because in an investigation extending over many towns it had been found that the work of the sanitary inspector was thorough, courageous, humane, sensible, and carried out with courtesy and tact. On the other hand, if any one would take the trouble to read the views of certain factory inspectors, printed in a pamphlet issued by the Women's Industrial Council, they would see that many of them are against home work, as home work. They had a perfect right to their private opinions. Every man had a right to his political opinion, but he had not a right to further his political opinions under the guise of protecting the health of someone else. That was why the Home Workers League preferred the sanitary authority; they were absolutely impartial, and did their work without the idea that the trade must be improved by turning out the poorest. She did not deny the right of any man to hold that idea, but she did deny the right of any one holding an official position to be influenced by such idea. Miss Irwin did not go far enough. The Bill would penalise the worker and the employer by putting the saddle on the wrong horse. She, herself, would like to quote Sir Samuel Chisholm, and say that no landlord should be allowed to take rent for an insanitary house, and not merely that the house of the home worker must be sanitary. It had been said with regard to the Home Work Bill, that the aim of that measure was not to stop home work. Well, that fact would be a poor consolation for the home worker if it *did* stop the work. Some manufacturers had already given up out-work on account of the trouble it gave them, and she believed that the selected and prosperous home worker would not always reap the benefit. In many cases the benefit would go abroad. Take Luton, for instance, where there was a four months' harvest for every one in hat making. The work was now half prepared in Japan, and the terror of the worker was lest it should all be prepared in Japan. Directly more responsibility and expense were put on the employer they would find it cheaper and easier to get the work done abroad, as part was done already. The whole town would suffer, and the better situated as well as the poorest would be sacrificed.

CONGRESS AT GLASGOW.

CONFERENCE OF MEDICAL OFFICERS OF HEALTH.

NOTIFICATION OF TUBERCULOSIS.

By JOHN ROBERTSON, M.D.,

Medical Officer of Health, Birmingham.

(Fellow.)

IN bringing this paper before you with a view to its forming the basis for a discussion on the subject of the Notification of Tuberculosis, I think it well to attempt to limit it as far as possible to the practical question as to what is the value of notification.

Our experience of the value of notification in this country is as yet very limited, and indeed so incomplete that one has to use it with extreme caution. Again, the experience in foreign countries cannot with safety be used, as the circumstances differ so widely from those in Great Britain with regard to the habits of the people and general sanitary state in the various countries where some form of notification is in operation. We have, therefore, to work out the problem for ourselves from the available data, and although I have had some experience of notification during the past five years, and am fully convinced of its advantages, I feel strongly that the subject is still open to serious discussion, for apparent advantages do not immediately accrue from the notification of any particular case.

Tuberculosis is relatively a very chronic disease when compared with the other acute infections we are accustomed to deal with. It has a stage of invasion of extraordinarily varying duration which prevents us from getting any definite clue as to the source and method of infection except

Note.—The Proceedings of this Conference commenced with an Address by Sir Charles A. Cameron, C.B., M.D., F.R.C.P.I., F.R.C.S.I. (*see page* 311).

in a very small number of cases. Then again, the influence of natural immunity is equally varying, and plays a much more important part in determining whether any person contracts the disease or not, than in the case of any other disease I know of.

All these circumstances make the measures for the prevention of tuberculosis differ very widely from those which we should take in the other acute infectious diseases we have to deal with; indeed, if I might depart from my thesis for one moment, I would like to lay emphasis upon a fact which I think has not been sufficiently recognised: that nearly every infectious disease requires to be dealt with differently, and that probably some of our want of success in the prevention of diseases like scarlet fever and diphtheria is due to the fact that our knowledge is insufficient. We have been far too prone to adopt isolation and quarantine as the two essential measures in the prevention of each and every variety of infection. Recent additions to our knowledge of the etiology of yellow fever and diphtheria, and of a number of other diseases, has shown us the futility of relying upon these methods alone.

As far as we are aware, the prevention of tuberculosis depends upon two separate and distinct lines of action. The first of these deals with all the means which we know of, which have for their object the strengthening of the natural immunity of the race. The second is the obvious one of limiting as far as practicable the spread of infection from the infected to the healthy. Notification of tuberculosis, by enabling us to amass statistics as to the various causes in operation, will help us to arrive at a proper appreciation of the part played by the many factors which are in operation in the production of any one case of tuberculosis.

We in this country are far too liable to jump to conclusions from small experiences we may have had as individuals. I would place as one of the prime advantages of notification the obtaining of accurate information from consumptives in the early stage as to possible conditions which influence the production of the disease and the source of infection. I am sure that without this accurate information our work must be more or less unsatisfactory.

What appeals most to the layman and to those engaged in public health work is the fact that tuberculosis in one form or another kills more people every year than any other known disease. Anything, therefore, which will tend directly or indirectly to the reduction in suffering and in loss of life from this most dreadful scourge is to be recommended. From the number of the people one has to deal with, therefore, notification seems to be the necessary preliminary step. I will leave out of account

altogether for the present the question as to whether notification should be voluntary or compulsory, and consider what is to be the effect of notification on the individual, his friends and relatives, his surroundings, and on the community as a whole.

The great stumbling block against the adoption of some form of notification has always been the effect which it would have upon the individual suffering from tuberculosis. It has been contended, often rightly, that notification will be to the prejudice of the individual, and should therefore, if allowed, be strictly guarded by requiring that the consent of the patient should first be obtained, and also that any action taken should in no way be to the disadvantage of a consumptive who has to go about his ordinary work. It has also been pointed out with some amount of force that a consumptive would be shocked and damaged by learning from the sanitary authority for the first time of the true nature of his disease. It has also been contended that the disease is so long standing that no patient would carry on the preventive measures with sufficient persistence and enthusiasm during the whole time of infection especially while he has to earn his daily bread.

Many of these objections appear to me to be not well founded, and in other cases they can be reduced so as to become unimportant. As regards the hardship which notification would entail on the individual patient, I would say, from an experience in dealing with many thousands of consumptives, that on only two occasions was any complaint made as to the action of the sanitary authority. One of these was a case of very acute tuberculosis of the lung in a nursemaid who had five little children under her charge, and who, I believe, lost her situation through her mistress getting to know that she was suffering from tuberculosis. Under any circumstances the mistress would have known, and if her mistress had not got to know I should have asked the nurse to have reported it herself, as I cannot imagine anything more dangerous than the circumstances which existed in this case.

The other instance of detriment to the patient occurred in a cottage house where the inspector went to make enquiries, and did not know and was not told that one of the persons present in the room was the consumptive herself. Her medical man had not told her that she was suffering from consumption, had not warned her she might convey the fell disease from which she was suffering to others, and the first information which she got of it was from overhearing the inspector's questions. This patient died a few weeks afterwards, and it was alleged that the action taken hastened her death.

Such cases as these will yearly get fewer in number. I can recollect that it was the custom 25 years ago, and that it was recommended by some teachers, that a consumptive should not be told of the nature of his illness. In view of what is now known of the infectivity of the spit and cough of consumptives I can imagine no more cruel practice under ordinary conditions than that of withholding the true nature of the disease from the patient in a case of tuberculosis. My own experience in dealing with a very large number of consumptives is that they take a real interest in the prevention of the disease, and are quite willing to take steps to prevent their friends from becoming infected by their own discharges. I therefore think that the objection which has been raised against notification, on the ground that it enables the patient to know what he is suffering from, will have no foundation in future.

The most important objection to notification is in regard to those cases where it is absolutely essential that the consumptive should go to work. I have known operatives on many occasions object to the consumptive when they saw him bring out his Deittweiller's spittoon and use it. For the same reason I have seen an omnibus stopped by an old lady who along with the other occupants got out when she saw a consumptive patient bring out a spit bottle and use it.

Such action, of course, results from ignorance. If these patients had spat upon the floor no notice would have been taken of it, but because they used proper means these ignorant people objected. I hope, and I feel assured, that the general education of the public will practically do away with all such prejudice against consumptives going about their ordinary business. On more than one occasion I have had to stop or to advise milkmen who had consumption to cease their work. I have done this, however, without notification.

In connection with the question of consumptives going to work, a point arises which I will deal with now rather than later on: it has been alleged, on such eminent authority as that of Dr. Robert Koch, that for practical purposes the spit of the consumptives is the means by which the infection is conveyed from one person to another, either directly or indirectly. It is not necessary here to go into the experimental evidence in regard to this point, suffice it to say that I think it is very convincing and has borne the test of 20 years' experience.

We have assumed that by collecting the sputum and destroying it that we should practically prevent infection from spreading. There is, however, another, and in my opinion nearly equally important factor in

operation. In 1886 I collected material from consumptives during the act of coughing and before the sputum mass was ejected from the lung. I found that fine particles of tubercular material are ejected by many consumptives during the act of coughing. Similar work has been done by others who found that during the act of loud talking particles are ejected, and that in that way it is possible that other infections are spread.

It is therefore obvious that to prevent a consumptive from infecting his fellows he must not only take means to collect the sputum, but also to prevent the fine particles being coughed out during fits of coughing. The second precaution I believe to be necessary, and specially so in the case of workrooms where cleansing is not so frequent. It will make it more difficult for a consumptive to go about his work without having attention drawn to him.

I have found it much more difficult to deal with this question of coughing than that of spitting. There is much more difficulty in finding a satisfactory means of checking the infection from being spread broadcast.

I believe that one of the weak points in dealing with notified cases of tuberculosis is our inability to limit the spread of infection from this source, especially among those persons who have to go out and work. We can, however, limit it considerably, and I do not think that this need prevent us from advocating notification.

The advantages to the community of notification will be, I think, very great in the near future. In the first instance, if one can limit the amount of infectious matter which is spread broadcast to one quarter of what it is at present, one will reduce the chances of susceptible people from being attacked. This in itself will be quite worth the trouble and expense.

But the main reasons which I would urge for notification relate to indirect benefit. They are as follows:—

It will enable accurate data to be prepared in each local community as to the causes in operation in the spread of the disease. Notification will enable steps to be taken to deal with all those insanitary conditions, which are quite as important as the question of infection. From information which I gained from notification, my sanitary authority were so impressed with the unhealthiness of one particular trade that our action resulted in this trade being scheduled as an unhealthy one, for which regulations were made. Doubtless other trades will follow.

Again, if notification will educate the general public and the sanitary authority into recognising that tuberculosis is a disease offering splendid

opportunities for prevention and cure, one half our battle will be gained. From my own limited experience this general education does result, although the process is a slow one.

A good deal of timidity is yet shown to adopting any form of notification, and therefore I believe that it is wise in all cases to adopt a system of voluntary notification as a temporary measure. By demonstrating in this way the fact that no hardship to the individual would occur, while the advantage to the community would be great, it was not difficult in Sheffield to obtain a local measure of compulsory notification.

In the case of voluntary notification we paid the usual fees. We limited the notification to cases of tuberculosis of the lungs. In the earlier years we asked that each notification should be accompanied by a sample of the sputum, and we only accepted the notification when tubercle bacilli were demonstrated by the authorities at University College, Sheffield. This was done to prevent hardship by having such cases as chronic bronchitis notified. Experience showed that this was unnecessary.

But voluntary notification casts a most objectionable risk on the medical practitioner who notifies without the consent of his patient, and it was mainly to protect the medical man that I urged a measure of compulsory notification. Most of you are aware that the Local Government Board has shown a hesitancy in sanctioning any compulsory measure. I believe that it has acted in the best interests of notification in doing so, and I should strongly deprecate powers being given to any sanitary authority who had not first acquired the machinery and experience derived from a system of voluntary notification.

I feel strongly that the power of requiring compulsory notification of tuberculosis should not be obtained, as has so frequently been suggested, by adding this disease to the schedule of diseases to be notified in the Act of 1889, but that special power should be obtained, so that tuberculosis might be dealt with quite apart from such diseases as scarlet fever or small-pox.

There are minor details added to the clause dealing with compulsory notification in the Sheffield Corporation Act, 1903, which I do not think are necessary, and there are some details omitted; but practically these embody the suggestions I made in 1898 for such compulsory powers.

[*The details of the scheme as carried out in Sheffield were here discussed.*]

It is always difficult to say what the real cost of such a scheme is, for so many of those (*e.g.*, the disinfecting staff) only devote part of their time to this work. Certificates of notification should not exceed four times the number of deaths. The whole expenses will not much exceed £120 per

100,000 of the population in a large town. The work on the lines indicated is therefore not expensive.

Dr. Wilson (Newcastle-on-Tyne) said he certainly thought that tuberculous disease, especially tuberculosis of the lung, should be notifiable. He hoped that some of the sanitary authorities, boards of guardians, and other public health bodies would take up the question of providing isolation hospitals for these cases, especially those occurring in the poorer districts of the towns. In the large cities one frequently came across families with a child or a father and mother suffering from tuberculosis of the lung living in perhaps one or two rooms. What were these poor people to do in the way of preventing the disease from spreading? It must be within the knowledge of every general practitioner who had been any length of time in practice that there were many cases of tuberculosis of the lung passed on from father to wife or to the children, and not the slightest means of prevention being taken. In Newcastle he had been urging the Board of Guardians to start with their paupers, who were just as deserving as any other section of the community. It was quite as much a matter of life and death with them as with any other class, and he thought the Guardians ought to try to provide some kind of isolation hospital in their own grounds or out in the country where these poor creatures might be cared for.

Dr. Vacher (Cheshire C.C.) said that personally he had been interested in this question of the notification of phthisis since 1894, when his authority issued an official memorandum on the subject. Amongst other recommendations which they then made, they suggested that the Borough, Urban, and District Councils should make phthisis (not tuberculosis generally) a compulsory notifiable disease. This memorandum was widely circulated throughout the County Districts, and the result was that a great many authorities in those Districts passed a resolution to the effect that they were in favour of making phthisis notifiable compulsorily. They were advised by him that the proper proceeding was to apply to the Local Government Board for sanction to take the necessary measures, in every instance the Local Government Board replied in the negative, and said they could not assent to anything of the kind being done. This produced a deadlock, and so things had to go on as before. Afterwards it was proposed that if they could not have compulsory notification they might have voluntary notification, and the question was raised as to whether there would be any objection to paying a 2s. 6d. fee as regards voluntary notification. The reply came that there would not be any objection to this course, and so a good many Districts have been able to pay a fee of 2s. 6d. for voluntary notification. As a result of these steps he could say that they had had singularly few notifications in all the Districts, some being of large area, one or two a year, perhaps,

and sometimes not one, so that at any rate, as far as the County of Cheshire was concerned, voluntary notification has been a conspicuous failure. Personally, he had been inclined to advise compulsory notification rather than voluntary notification, because the latter was throwing a disagreeable duty upon general practitioners. It was really asking medical men, in a sense, to make known facts communicated to them as private practitioners, and to divulge privileged communications. This, at any rate, seemed to be the view of medical men in the Districts, and they felt they were scarcely justified in making the notification unless such notification were made compulsory. Hence his original opinion held good, that if there were to be any successful notification of phthisis it must be compulsory.

Dr. J. E. Gould (Bolton), said that they had had a little experience of this sanitary measure in Bolton, and he thought he could say they had been fairly successful with voluntary notification. The system had now been advocated for some time, and he had expected Dr. Robertson to suggest what was the next step to be taken in the matter. There had been no complaints from the medical practitioners in Bolton, and they had no difficulty with them or with the sanitary committee in the adoption of voluntary notification. People now raised no objection to the disinfection of their houses. They had also been getting on the way to a sanatorium, and had had no difficulty in inducing the sanitary committee to pass a resolution that a certain sum of money should be set aside for that purpose. The difficulty was now in obtaining a suitable site. It was interesting to hear of the little difficulties experienced in other districts. They all had special local conditions to deal with, but he thought the time had now arrived for all parties to combine in passing frequent and continuous resolutions until they got both the Local Government Board and the various sanitary authorities to make up their minds that compulsory notification of this disease is indispensable in order to prevent tuberculous infection of any kind.

Dr. A. Wellesley Harris (Lewisham) said that there could be no doubt as to the usefulness of voluntary notification of phthisis, but so far it had not been tried in very many districts. He begged the conference to reflect and consider very carefully before they passed any very strong resolution in favour of the compulsory notification of tuberculosis. Phthisis differed so entirely in its character from the infectious diseases which at present were notifiable. Any of the notifiable diseases could be easily determined, the period of notification was definite, and the remedy was isolation in fever hospitals. There was a certainty of recovery in a short or within a reasonable period. In the majority of cases, at any rate, there was a certainty of these persons becoming again in a fit state to return to the general community. But with regard to the notification of phthisis, although he might be in the minority, his opinion was

that it is a very different disease, both in duration and character, and therefore its public treatment requires special consideration. If that disease were made compulsorily notifiable they would surely have to adopt all the sections appertaining to the notification of infectious diseases, with consequent disinfection. Then the same thing would occur as occurs when other infectious diseases are notified to a sanitary authority, and the notification could never remain perfectly secret. Thus they would be ear-marking the bread-winners of many families as a diseased person and as an outcast. This was all very well, but they would even have to go further under a system of compulsory notification. They would have to find means not only for isolating the patient for weeks, but perhaps months, and for the maintenance of the persons who might be dependent upon the sufferer who was to be isolated for so long a period. What was the experience already gained in regard to sanatoria? Previously, patients used to be discharged as cured, but now the medical officers of these sanatoria were modifying their views. They did not now discharge these persons as cured, but only as temporarily relieved, or with the disease as temporarily stopped. There were no practicable or possible means of following these patients up, and the result was they went back to their homes apparently cured, and they might and frequently did have fresh outbreaks of the disease within a very short period. With regard to the sanitoria being useful educationally, no one could doubt this for a moment, but he did urge medical officers of health generally, and others who might be interested in this particular subject, to pause before they took what was in his opinion a drastic step, and committed themselves to the principle of making phthisis compulsorily notifiable, which, if enforced, would entail very considerable hardships on certain sections of the community.

Councillor R. Laurie (Derby) observed that he was glad to hear Dr. Wellesley Harris opine that voluntary notification of phthisis was a success, because that was an opinion which was supported by his experience in Derby. In that city they had for a number of years taken great interest in this particular health problem. The medical officer of health had for a long time adopted the practice of writing to every house where a death from phthisis had taken place, requesting permission to disinfect the rooms.

Dr. Munro (Renfrew County) said that he had a strong constitutional objection to crusades of any kind. Things must be getting very bad with sanitation when it became necessary to indulge in crusades. References were continually being made to the infectious character of phthisis, and suggestions made for dealing with its infection, when at the same time obvious means by which such infection was spread were being overlooked. He was constantly dealing in plans of dwelling houses with questions of ventilation "box-beds," as they were called in Scotland, rooms unprovided with fireplaces, and other

agencies which are concerned in the distribution of phthisis, from which matters some medical officers held ostentatiously aloof. They had in their meeting-places—and he did not even except the University of Glasgow from the category—most vitiated atmospheres which must tend to the deterioration of the breathing organs and assist the spread of phthisis among persons of phthisical tendency. Long ago, when the sanitary authorities of Jarrow were obtaining a local Act of Parliament, they secured powers—he did not know whether similar powers existed anywhere else in the country—for the Corporation to inspect all the public buildings in the town in order to secure that the ventilation and heating arrangements should be satisfactory to the health authority, acting on the advice of the medical officer of health. Twenty years ago, before this crusade against tuberculosis became fashionable, they were at work on these lines, successfully as was now shown by the statistics in regard to consumption. He was not in favour, therefore, of compulsory notification, being inclined to advance slowly and surely by a system of voluntary measures.

Dr. W. G. Willoughby (Eastbourne), said he did not desire to go into the details of the way in which voluntary notification in his district had been to a great extent a success. But he had largely followed the policy indicated by Dr. Laurie, of Derby. Before the matter was brought before the Sanitary Committee he had brought the question concretely before the local medical practitioners, with the result that the members of the local medical society were working in this matter in entire harmony with the public health authorities. He opined that it was most important to get the medical men of the town to agree to the voluntary measure before it was finally passed by the Sanitary Committee. When voluntary notification was started, it was desirable to go on lines such as these: Distribute a form with three alternatives; "leave the whole of the steps to be taken in this case to me"—*i.e.*, the medical practitioner; secondly, "take no steps in this case unless in consultation with me;" and, thirdly, "take any steps you may please in regard to this case." Two of these lines could be struck out by the medical practitioner, and the system seemed to work fairly well, as was proved by the very large proportion of cases that were notified. Of course, the cases that were notified under this voluntary system were mainly the poor and advanced cases, and these were just the cases that the health authorities desired to advise upon.

Dr. H. O. Pilkington (Preston), believed that in dealing with this important question notification should either be complete—*i.e.*, compulsory—or there should be no notification at all. Those who advocated compulsory notification had, he thought, hardly sufficiently weighed up the tremendous issues which would obviously be at stake. Great issues, for instance, evolved upon the patient in his employment, upon the employer, upon the

medical profession, and last, but not least, upon the municipal authority, which would have to bear not only the cost of notification but also the cost of any subsequent necessary proceedings, because if notification was to be followed to its logical conclusion there must of necessity be hospital isolation afforded to the patients, and there must also follow the whole process of disinfection and inspection, all these proceedings being of a costly nature. He was of opinion that the true remedy for phthisis was in general sanitation, in improving conditions under which the people dwell, in better drainage, in better housing, in better ventilation, and in the better instruction given to the public in feeding, clothing, in greater attention to the sanitary conditions of the household, and in education upon the dangers of such things as early marriages and intermarriages.

Dr. T. Goodall Nasmyth (Fife) said he did not think it was quite logical to state that there should not be compulsory notification, because what did they look for from notification? They wished to obtain information, to know whether the infected person lives, and to know of the existence of infective material. If they adopted voluntary notification, these advantages were obtained in a certain percentage of cases, but what about the other percentage of cases? To be genuine and real in their system, they would not get the best results until they had compulsory notification, under a special Act of Parliament or under existing Acts of Parliament. He therefore threw in his lot with the advocates of compulsory notification.

Dr. S. Barwise (Derby) said it would be quite ridiculous for some of the rural authorities, and even for some of the urban authorities, which were not advanced and had no adequate machinery, to have these intimations and pay for such information. But other authorities, say the County Boroughs, in whose districts there exist sanatoria, and which were thoroughly up to date in every way, the notification might be made with advantage, because they were ready for the measure. The way in which all our progress was made in sanitation was by passing adoptive Acts, which were worked by all the large towns, the pioneers of sanitary progress. They showed what could be done, and then in ten or fifteen years' time the general Act was passed to bring the whole country up to the level reached by the large cities.

Dr. G. P. Johnson (Stoke-on-Trent) remarked that a few years ago, in a Staffordshire pottery district adjacent to his own, the district council passed a resolution in favour of voluntary notification, and circularised the medical men in their district and the neighbouring districts, requesting them to notify the cases voluntarily. Soon afterwards, the medical society of the locality met and passed a resolution to the effect that medical men were not in the habit of disclosing the ailments from which their patients were

suffering, unless compelled to do so by Act of Parliament. Later, he believed, the city of Manchester, where voluntary notification had been tried for some time, decided that it was desirable to apply for compulsory powers of notification, and thereupon the medical men there met and passed a resolution to the effect that as voluntary notification had worked fairly satisfactorily, compulsory notification was not necessary. It would, therefore, be seen that in these two cases there was no opposition to the notification of tuberculosis of the lungs, and it was only a question of voluntary or compulsory notification. He confessed that he had very little faith in any voluntary measure. If notification were feasible and desirable there was only one way to ensure success, and that was to make notification compulsory. As to the methods of dealing with these cases, the position would be entirely different from ordinary cases of infectious disease. No one would dream, at any rate just at present, of applying the same methods as are applied in the case of zymotic diseases. In Staffordshire, where the question had been very prominently before the medical profession and the inhabitants for some time, the County Medical Officer of Health was bringing forward a scheme for the provision of a sanatorium, but certainly it had not been proposed to isolate the cases in any way as a result of notification, but simply to receive the cases for a certain length of time, and to endeavour to educate them upon the precautions that should be taken.

Dr. E. Walford (Cardiff) regarded the observations of Dr. Barwise as being particularly valuable, and thought the conference should do all it possibly could to support those views. It seemed to him that it was quite obvious that a short and simple adoptive Act was the only real and practical method of dealing with this question. It was perfectly certain that such a disease as phthisis would never be included by the Local Government Board in the present Notification of Diseases Act. The various sections in that and other Infectious Diseases Acts were totally inapplicable to dealings with phthisis. He had very little faith in compulsory notification, or indeed in any compulsory processes at all in these matters. If they considered the matter fairly they would see that unless they had full and complete co-operation from the private medical practitioners—a voluntary co-operation after all—they would not be as successful as they were in dealing with other infectious diseases. He was certain that if they attempted to introduce compulsory notification of phthisis they would raise the opposition of many medical practitioners in many districts. Each district must be dealt with on its own merits. Compulsory notification might answer well enough in some large manufacturing districts where there is a large artizan and poor population, but in districts where the better classes are in a majority there would undoubtedly be difficulties in carrying out compulsory notification of this disease. What they should really try for was to secure an adoptive Act. There was voluntary notification of phthisis in Cardiff, with a population of 180,000, and voluntary notification had been a fair success,

viz., they had perhaps from 100 to 200 notifications per annum, though certainly 25 per cent. of those notifications were in connection with the Poor Law institutions, from the board of guardians, the union workhouse, and the district poor law medical officers, but on the whole the system was a success, and they dealt with all the cases alike, viz., by sending the Health Visitors to the houses as is done in the case of general sanitary matters. But he did not think that they were really ripe yet for compulsory notification. In any case he would be rather averse to advise any such proceeding unless it was with the complete co-operation of the medical men in the district.

Dr. W. Butler (Willesden) said he had ventured the other day to express the opinion that the time for the compulsory notification of phthisis had not yet come, and he did not think that much had been said during that discussion which indicated that the time had arrived. Voluntary notification, to his mind, was essentially a failure, because as had been pointed out, no medical man had any right to violate the confidence of his patient, except under the compulsion of the law. That seemed to preclude the possibility of voluntary notification being a success unless the patient was a consenting party. If the patient were a consenting party then there was no need for notification, because to begin with they had got a medical man who knew what was wanted, and what precautions to take with regard to the disease, and a patient who was willing to carry out his instructions, and so the advent of the medical officer of health under such circumstances was not required. Where the medical officer of health, or the assistance of the public health authority was required, was in the case of obstructive patients, or where the administration of the law was opposed. That he took it was the object of bringing in the medical officer of health, and the power of the forces at command. But if they were intending to insist upon compulsory notification they were going to introduce an exceedingly expensive piece of administration. What were they going to get in return? What did they propose to do? No one suggested that there should be anything like the same powers used in regard to consumption as are used with regard to other infectious diseases. It was not proposed to place the consumptive in the position of a leper, or of a scarlet fever patient. There was no suggestion that there should be compulsory powers of removal to hospital—the most that was suggested was that they should instruct the patient or his friends, and disinfect. As regards instruction, all these cases were under the care of a medical man, and there was not the least doubt that only by the co-operation of the local medical men could they hope to do any real good. If a medical man, not under compulsion, did notify, was he likely to instruct his patient any more or any less? He took it that in these days no medical man was so benighted as to refuse the advice that medical officers themselves would give; and if nothing more was to be done in the way of instruction than is at present done—and he believed that little more could be done—there only remained disinfection. But disinfection

was already carried out at the termination of the case, and in how many cases could disinfection be carried out before that time? They had knowledge of the case when the death returns arrived, and it was not practicable to offer disinfection in many cases prior to this issue. If they had compulsory powers, the only other value would be the ability to disinfect during the continuance of the case, and when the patient removed from one house to another. Where then was notification going to help them materially?

Professor H. R. Kenwood (London) said that he had had experience of the notification of consumption in the metropolitan borough of Stoke Newington, and Dr. Butler had given what in his opinion was such an inadequate expression of the value to be derived from the measure, that it was incumbent on those who held different views and who could speak from experience upon the subject of the voluntary notification of consumption, that they should endeavour to remove such misconceptions. In the first place, Dr. Butler asked what public health administrators were going to get out of a voluntary system of notification? And he suggested that a medical man who thought it necessary to notify voluntarily would undertake that certain precautions should be observed, and the circumstance that the patient gave his consent to the notification indicated a willingness to adopt the medical precautions advised. That was not his experience in Stoke Newington. What happened in practice was this: generally, as one speaker had properly said, the notification received was a case of the very poor, and the case was generally advanced; indeed, it was usually the advanced cases that came under voluntary notification and those were the cases that were most infectious. But these poor people could not afford to pay a medical man to come frequently to watch and advise; probably he called once a fortnight, and was generally a busy dispensary medical man. Then came the opportunity of the medical officer of health or his assistants to give advice and assistance; perhaps to contrive better ventilation, make suggestions as to sleeping, and redistribute them in their two or three rooms. A district visitor was put on to them, verbal advice and encouragement were given and the patient was frequently visited, disinfectants were given gratuitously, spit bottles were provided when necessary, and cleansing of the premises was arranged for during the continuance of the disease, because it was recognised, as Dr. Robertson had reminded the Conference, that even by coughing the tubercle bacilli would get into a room, no matter how careful the patient was with the sputum, and therefore it was most necessary to carry out some measures of disinfection while the patient occupied that room. He thought that in these ways they got value for the money spent; in fact, he held strong views that the community derived great benefit from the system of voluntary notification of consumption in London. But he would admit that to some extent the measure was disappointing because they did not get as many notifications as they

expected, or as they ought to receive. But that, he thought, was rather an argument in favour of compulsory notification than of the abolition of the voluntary system.

Dr. H. Scurfield (Sheffield), remarked that he had experience in regard to the systems both of voluntary and compulsory notification of phthisis. In Sunderland they had voluntary notification in force, but they did not as a result get a large proportion of cases notified. There had been similar experience in other districts. He certainly believed in the efficacy of getting most of the cases notified. Even with compulsory notification all the cases were not notified. Certainly, at present it was semi-compulsion; deaths from phthisis occurred every now and then of cases which had not been notified. But the Act had only been in working order for six months, so that probably all the medical practitioners had not yet learnt about the compulsory clauses. Reference had been made to the enormous cost of the measure. In Sheffield the cost was the salaries of two inspectors who visit the consumptives. There were about 600 consumptives on the register, and these were visited about once a month, and in the case of those patients who were suffering from an advanced stage of the disease and were confined to their rooms disinfection was carried out. Where the family occupied more than one room and the patient was confined to his room, he was removed to another room, and the room he had occupied disinfected with Formic Aldehyde. This was possible if a room could be left unoccupied for four or five hours. Those patients who could not afford to pay for pocket spittoons were supplied—a satisfactory spittoon could be obtained at the cost of 4½d. The salaries of the inspectors were £100 for one and £78 for the other. The inspectors on the first visit gave instructions, and on the second visit ascertained whether their instructions were being carried out. He was glad to say that it was generally found that the instructions were observed, and that the patients used the spittoons and also opened the window. He thought that these measures were valuable. It was very unfortunate that the proposal for a sanatorium made when the Act of Parliament was obtained, had now been dropped. It was not isolation of the patients generally that was required; all the isolation needed was for that very small percentage of advanced cases which were improperly housed, a sort of home for incurables, and that provision must be made in the district where the patient lives in order that his friends and relatives can have ready access to him. This home for advanced cases was quite a distinct thing from the sanatorium for the curable cases. They did not want to talk about isolating consumptives, and in Sheffield there was no suggestion of regarding consumptives as lepers. There was no friction whatever with the medical men in Sheffield through the compulsory powers, and as regards the very well-to-do people, if those cases remained unnotified it did not really matter very much, because under those circumstances precautions were taken and instructions carried out. But in the case of the poor people, attended per-

haps by a club doctor, the conditions were different. Would the club doctor pay the necessary visits and see that the necessary instructions were carried out to prevent the spread of the disease? He thought not.

Dr. J. Robertson (Birmingham), said that two points had been raised to which he would like specially to refer. One was that from his own experience and observation in dealing with a great many cases of consumption that were notified, if he were the medical man attending those cases he would not notify unless compulsorily required to do so. In two or three cases he had had to get medical men out of a difficulty. Entirely for the reason of protecting medical men from the risk of action for damages had he recommended the adoption of compulsory powers of notification. The other point was that it had been stated that medical men had the time and did take the trouble to instruct their patients in preventive measures and precautionary methods; with a certain class of medical men that was undoubtedly the case, but his own experience among the working classes was that they get practically no instruction whatever, and that unless it was given to them by the sanitary authority nothing was done for them in this direction.

THE CONTROL OF THE SMALLPOX CONTACT.

By J. KNIGHT, M.D., D.P.H.

THE term "contact" is conveniently applied to those persons who have been exposed to infection, either through more or less close association with a smallpox patient, or from having been brought into touch with definitely infected articles.

The contact constitutes a menace to the public health in two ways :— (1) the infective germs on his clothing and skin may be transferred to other individuals, even though he himself should escape the disease. But the necessity for his proper supervision and control by the medical officer of health is made more urgent by the fact that (2) having been exposed to infection, he is almost certainly incubating the disease (unless protected by recent vaccination), and may constitute a new focus of infection in a different neighbourhood from that in which the original case occurred. He is therefore to be regarded as a potential smallpox patient.

It is thus of great importance that all the contacts with a given case of smallpox should be discovered and dealt with. Here, however, the difficulties of the medical officer of health begin. Should the patient have been stricken down by a severe attack, which confines him immediately to bed, and results in prompt medical attendance, there will have been but little opportunity for the spread of infection. In such a case, the contacts will practically consist of the members of the household. On the other hand, if there be delay in securing medical aid, and the nature of the disease continue unrecognised, the scope of the infectivity of the patient is greatly increased by the presence of visitors in the infected house or room. But if the patient's attack be, as is frequently the case, so trifling as to necessitate neither medical care nor confinement to the house at any period of the illness, then it becomes well-nigh impossible to ascertain all those to whom he may have conveyed the infection. The most that can be done is to deal with the household, the visitors, those whom

he has visited, and those associated with him at work. As for those whom he may have infected by casual contact in the street, public meetings, or conveyances, they continue of necessity undisturbed by the local authority, and may spread the disease in all directions.

With the educated, there is no difficulty in obtaining bona fide information, so far as lies in their power, regarding those who have come into contact with the patient. But human nature is frail at the best, and a defective memory may cause sundry names to be omitted from the list.

With the poorer classes, however, the case is not so simple. They seldom can be brought to realise that, in seeking for information, the sole object of the medical officer of health is to protect the contacts themselves and the general public. Often at the back of their minds there seems to lurk a vague idea of possible prosecution for themselves and their friends. Frequently, it may be, they are animated by the laudable desire of sparing their friends trouble and inconvenience. Whatever the notion may be, there can be no doubt that information is wilfully withheld, and totally misleading statements made. It is only when inquiring into the history of some subsequent case that direct association with a previous one is ascertained. Had this fact been disclosed on the occurrence of the previous case, in all probability no secondary attack would have followed. The law imposes penalties for the failure to notify infectious disease, but it often happens that the failure to disclose contacts is fraught with as disastrous results to the community as the concealment of an infectious patient.

It is much to be desired that the law should be altered, so that penalties might follow the wilful concealment of information regarding contacts.

Apparently Liverpool has managed to secure such a provision in the private Act of 1902, and the medical officer of health for that city is thoroughly convinced of its utility. Of the urgent necessity for a similar clause being embodied in the general Public Health Act, my daily work brings me striking proofs.

Assuming, for the moment, that the contacts with a particular case have been discovered, the question comes to be, what is to be done with them? The answer to that is to be found from a consideration of the two-fold manner in which they may spread infection.

By the immediate cleansing and disinfection of their body-surfaces, clothing, and houses, danger to the public from this source is arrested. Not only so, but the rapid removal of the infected materials and the cleansing of their bodies greatly minimise their chance of actually becoming infected, quite apart from special prophylactic measures.

Desirable as such treatment is, it is not enough in itself. The contact may be developing the disease, although to all appearance quite well, and new foci of infection will be formed. Prompt vaccination or revaccination, as the case requires, will frequently protect the contact, especially if his previous exposures to infection have been limited in point of time.

In our experience it is quite the exception for secondary cases to occur, should the original patient be isolated in hospital by the third day of the eruption, and the contacts dealt with on the lines above indicated. On the other hand, it will frequently occur that the contacts have been subjected to prolonged exposure, and that vaccination has been performed too late to save them. In any case, it is advisable that the contact should be under observation by the medical officer of health until the full period of fourteen days has elapsed since his last day of exposure.

Whilst the measures outlined above are indicated in every class of contact, their practical application will vary in sundry circumstances. Perhaps the chief factor in such a variation will be the social status of the contact. Lest it be assumed that this is making invidious class distinctions such as no local authority should countenance, let me hasten to assure you that it is entirely a matter of expediency. Two examples may serve to illustrate what is meant. Suppose smallpox occurs in a well-to-do family: there is no difficulty in completely disinfecting the house; there are ample facilities for bathing, and the family's own habit may make this a daily ritual; complete change of clothing is easily obtained; the contacts recognise the necessity for immediate revaccination, and readily consent to be supervised by their own medical attendant for the requisite period. The actual work of the local authority may be limited to disinfection of clothing, bedding, rooms, etc.

Taking the other end of the social scale, let us imagine smallpox breaking out in a very poor family. The house cannot be disinfected until they are out of it; they have no change of clothing; and not only have no facilities for cleansing themselves, but even the strongest antipathy to undergoing the unheard-of ordeal of a complete bath.

They fail utterly to recognise the necessity for vaccination, and prefer to run the risk of infection than to encounter the certain discomfort arising from vaccination. The very house they occupy may be hired nightly, so that supervision at home would utterly fail, as they might suddenly vanish without the slightest warning, while their scanty furniture forms but a slight impediment to their migratory instincts. Obviously, in such an instance the medical officer of health has his hands full, and the control of such contacts demands a procedure entirely distinct from that

in the previous example. Between these extremes all gradations are met with, and the procedure has to be varied accordingly.

Where the general type of housing gives, as in England, each householder immediate access to the street or court, there are not many facilities for spreading infection; but where, as in Glasgow, the poorer classes are closely packed in large tenements,* access to each house being obtained by a common stair, with, in many cases, dark and tortuous lobbies on each landing, the danger of infection spreading becomes much greater. The common passages facilitate the frequent meeting of the neighbours. The close proximity of the dwellings encourages visiting. The elder children play together in the street or court, while the younger and more timid make the stairs their playground. Add to this the use in common of water-closet accommodation, washhouse, &c., and it will be readily understood how infection, once introduced to such a tenement, may spread with alarming rapidity. Such conditions have made it imperative that all infected houses and persons should be promptly and efficiently dealt with. To meet this demand, the reception-house was established in 1872, although statutory powers regarding it were not obtained until 1890 (Glasgow Police Amendment Act, 1890, sec. 5). By the more recent Public Health (Scotland) Act, 1897, somewhat similar powers have been conferred on all local authorities by sec. 47, sub-sec. 4.

Removal of the inmates of the infected houses to the reception-house enables complete disinfection of their homes to be carried out. Were the condition of detention for a certain period not attached, the value of the reception-house would be greatly lessened, as no sooner might the family have returned to their purified home than another of its members might sicken of the disease.

In dealing with reception-house inmates the assumption is made that a disease is not infectious during the incubation period. Hence, no restriction is placed upon their resuming employment during the period of observation, nor have any untoward results followed this practice.

It is needless to describe here the plan or construction of the reception-houses, as this has been done in the handbook distributed to the members, and the houses are thrown open to inspection during the Congress.

On entering the reception-house the contact has a hot bath, during which his infected clothing is removed, and new apparel substituted. His

* The word "Tenement" in Scotland denotes a building of one or more storeys (generally three or four in large towns) arranged in flats, with two or more separate occupancies on each flat. In England the term seems to denote a separate occupancy, *i.e.*, the apartments occupied by a family or others, constituting a separate household.

own clothes can be returned from the sanitary wash-house in twelve hours, and by that time he is at liberty to resume work.

If not previously vaccinated, the operation is now performed, and the result inspected daily, so that the inoculation may be repeated if necessary. He is boarded and lodged during his period of detention, and the only restrictions placed on his movements is that he must at least sleep in the house. When, as occasionally happens, the contacts have been successfully revaccinated before their exposure to infection, they are discharged whenever their homes have been disinfected. Otherwise, they are detained for 14 days from their last date of exposure.

In the reception-house, the preliminary bath enables a close scrutiny of the contact's skin to be made, and many missed cases of smallpox are thus brought to light.

The advantages of the reception-house may be summarised as follows :—

1. Complete disinfection of the infected house is rendered possible.

2. The contacts are immediately freed from infected matter, and their chance of infection is minimised.

3. Revaccination is carefully watched and repeated when failure occurs.

4. The first indications of disease receive medical attention, and the patient is promptly isolated.

5. Missed cases of smallpox are rendered easier of detection.

6. The standard of personal and domestic hygiene observed in the reception-house is of considerable educative value.

From the system of housing already referred to, it is clear that the inhabitants of a particular tenement must be considered contacts, although indirect. Vaccination is urged, and the whole tenement kept under daily observation for at least 14 days after the removal of the patient.

An ambulatory case of smallpox, continuing at work, may infect numerous individuals who cannot be traced. If possible, the squad of workmen to which he may be attached is ascertained and treated as direct contacts. Disinfection of tools and other articles he has used, is carried out. For the works generally, revaccination of the employés is advocated, and reports are received of any absentee. Such an one is visited and kept under observation until it is clear that his illness is non-infectious.

Large lodging-houses constitute a source of danger when a case of smallpox occurs in them. By offers of free board and lodging, revaccination may be secured. For 14 days close watch is kept upon the inmates, and occasional night raids enable missed cases to be detected.

These are the chief measures applied in the large Scottish towns, and

no attempt is made in this paper to deal with the problem of supervising the contacts in rural districts.

Glasgow Police (Amendment) Act, 1890.—Section V.

"When infectious disease exists or has existed in any overcrowded house, or in any house occupied or used for the purpose of sleeping in by persons in excess of the numbers * allowed by this Act, which cannot, in the opinion of the medical officer be thoroughly cleansed and disinfected while the inmates continue to reside therein, or in any house the inmates of which are unable to provide themselves with clothing or bedding which is clean and free from infection while their clothing or bedding which has been exposed to infection is being washed and disinfected, any magistrate may on the application of the procurator-fiscal or sanitary inspector, on production of a certificate signed by the medical officer of health that the removal from the said house of all the residents therein who are not suffering from infectious disease is necessary to prevent the spread of such disease, grant warrant to remove the said residents to the reception-house provided by the Police Commissioners, who shall accommodate and maintain such persons therein for such period, not exceeding fourteen days, as the medical officer may consider necessary for the public safety, and such warrant shall be sufficient authority for any officer of the Police Commissioners to compel the removal from the said house of the residents therein to the said reception-house, and to prevent the return of any of the said residents until the said house, and all their bed and body clothing, has been cleansed and disinfected to the satisfaction of the medical officer or sanitary inspector."

Public Health (Scotland) Act, 1897, Section 47, Sub-Section 4.

"If the local authority deem it necessary to remove from any house, or part thereof, or from any tenement of houses, all or any of the residents not being themselves sick, on account of the existence or recent existence of infectious disease, or for the purpose of disinfecting such house or part thereof, they may make application to a sheriff, magistrate, or justice, and the sheriff, magistrate, or justice, if satisfied of the necessity of such removal, may grant a warrant authorising the local authority to remove such residents, and imposing such conditions as to time, and otherwise, as to him may seem fit. Provided always that no such warrant shall be necessary when the removal is carried out with the consent of any such resident or his parent or guardian. The local authority shall, and they are hereby empowered, to provide temporary shelter or house accommodation, and, if necessary, maintenance, with any necessary attendance, free of charge, for such persons while prevented from returning to such house, or part thereof."

Public Health (Scotland) Act, 1897, section 66, (1), confers upon local authorities the power to provide and maintain hospital for infectious diseases, and houses of reception for convalescents from infectious disease, and for persons who have been exposed to infection.

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* "Numbers allowed by the Act." These words refer to a provision adopted and amended from the 1866 Act, whereby 400 cubic feet is the standard fixed for an adult, and 200 cubic feet for a child under 10 years.

By their adoption of the Infectious Diseases (Prevention) Act, 1890, local authorities in England, Wales, and Ireland may avail themselves of the powers conferred by section 15.

> "The local authority shall from time to time provide, free of charge, temporary shelter or house accommodation, with any necessary attendance, for the members of any family in which any infectious disease has appeared, who have been compelled to leave their dwelling for the purpose of enabling such dwelling to be disinfected by the local authority."

No power, however, is given to the local authority for compelling removal to a reception-house, nor for the detention therein of the contacts for any specified period.

Hence, in connection with the previous outbreak of small-pox in London and neighbourhood, we find local authorities coaxing contacts and paying them during their period of voluntary detention.

Dr. H. Scurfield (Sheffield) thought they would all agree with what had been said by Dr. Knight. It was generally possible to have similar arrangements to those described, without large expense. In Sunderland they had used the vacant wards in the isolation hospital for housing the contacts, who, as a rule, were not in there more than two nights, while their homes were being thoroughly disinfected, and they were re-vaccinated. It was a great advantage to vaccinate in a place like that, where they could all be kept in bed while their clothes were being disinfected. Under these circumstances everybody was vaccinated without any real compulsion—a sort of moral persuasion. At Sheffield the hospital committee bought two or three cottages next to one of the hospitals, and these were used for the same purpose as the Glasgow place. Such arrangements as those he had described could be well carried out in almost every isolation hospital, and it was not necessary to specially build a place, and keep it for that purpose.

Dr. Eustace Hill (Durham) said in the County of Durham there were several large joint smallpox hospital districts, and unfortunately during the past 12 months they had been visited with a considerable degree of smallpox. In one area there were no less than six small urban districts and a large rural district. For these there were a joint smallpox hospital, and the medical officers of health of every one of these districts had complained in the strongest possible terms in their annual and special reports of the lack of a central receiving house. There was no accommodation in the wards of the hospitals for the reception and disinfection of the contacts, and they all knew how important that work was in dealing with an outbreak of the disease. A result of this

lack of accommodation had been that in nearly every one of those districts there had been other cases of smallpox traced to the want of a central reception room for contacts. These were good reasons why they should strongly advocate the institution of these reception houses, not only in large urban districts as Dr. Knight had so ably advocated that day, but also in all hospital districts.

Dr. C. H. Templeman (Dundee) said for the last three or four years they had been assailed more or less by smallpox, and he attributed the fact that the disease had never got a hold, largely to the existence of the reception houses. In Dundee, with the exception of perhaps six or eight weeks, they had never been quite free from the disease and yet they never had more than 40 cases in any one year, and that with a population of 170,000. Dr. Scurfield had referred to the detention of contacts in connection with hospital buildings, but the great advantage of reception houses such as Dr. Knight had described, and such as they had in Dundee, was that they were situated in populous districts of the city, so that the contacts could get to their work, and return to the reception house for their meals. In this way the contacts were quite ready and willing to go to the reception house when they were so conveniently placed, and as a matter of fact most of them got better attention and better food than they got in their own homes. The medical officers of health in Scotland had this great advantage over their colleagues in England, that under their Public Health Act they had compulsory powers of removal of contacts to reception houses. That was a provision greatly to be desired, and it should be applied as quickly as possible in England.

Dr. McVail (Stirlingshire and Dumbartonshire) said there was one practical point that he would mention. Dr. Knight had referred to the fact that smallpox is not infectious in the incubation period. They would all agree with that, but as one having a constant communication with other medical officers of health he suggested that in sending information they should make a point of mentioning the date when the patient sickened and when the eruption appeared. Attention to this simple rule would save much time and labour.

Dr. J. Robertson (Birmingham), asked Dr. Knight to explain who would be, under his system, considered contacts as in the case of workpeople where a man had been working in an infectious condition for some days before he was discovered? Would they treat the whole of the other workpeople as contacts? Then also in the case of a lodging-house where a man had been living, say, for a week, and was then found to have contracted smallpox. What would be done with regard to the other inmates?

Dr. E. Walford (Cardiff) asked for what length of time the contacts

were kept in the Glasgow reception house under observation. It was a practical point of much interest. After having read the interesting report of Dr. Bruce Low on smallpox in Germany, and the equally interesting report of Dr. Armstrong on the subject of tramps, they would after all agree that the real point was to secure compulsory powers of re-vaccination, especially in the case of those who are under the care of public bodies, like Boards of Guardians. If they could secure the re-vaccination of all the tramps who came into the casual wards of the various Unions in this country, he felt sure very much less would be heard about the spread of smallpox.

THE CHAIRMAN (Dr. H. E. Armstrong, Newcastle-on-Tyne), in closing the discussion, said with regard to the practice in Newcastle, there they did things in a more thorough way than perhaps was done in Glasgow. Contacts were kept for thirteen days in the isolation house. The only power they had to do this was the power of persuasion, and as this policy was carried out in a proper way, he was glad to say they were practically successful in every case. In one case, an old nurse, an obstinate person, objected, on the ground that the authorities had no power to compel her to go, which was quite true, but upon his threatening to lock her up in the house in which she lodged as a person likely to convey infection, and, if she went out, to prosecute her, her obstinacy gave way, and she was revaccinated as well. Some thought that thirteen days was too short a time, but in view of the incubation period of smallpox that practice was adopted with successfully revaccinated cases, but where there had been no successful vaccination the contacts were kept in for seventeen days, they were fed, and the wages of the bread-winners paid by the Sanitary Committee. As proof of the advantage of having this system, he mentioned that out of thirty-three cases of smallpox occurring in a fortnight, ten per cent. of these developed the disease in the isolation house. In certain cases the contacts were allowed to go out to their business and to return to the isolation house at night, as was done in Glasgow, but that was only where the sanitary officers had absolute control over the persons, and was never done unnecessarily. They had not had a large number of contacts in at one time, perhaps 150, and these could be managed very well. With regard to the suggestion of Dr. McVail as to reporting to colleagues the date of the commencement of sickness and the date of the commencement of the spots, he quite endorsed this suggestion. It was information which should be given precisely on each notification form, although it was often forgotten by medical men. He always made a point of giving that information precisely when sending information with regard to the patient. No doubt the cost of the system adopted at Newcastle was large, but the sanitary authority was satisfied that the course they were pursuing was the right course. The question of expense in the earlier stages of an epidemic should not be considered for one moment. What was a contact? Well, contacts could be divided into two kinds, the direct and indirect, and so far

his remarks had only been applied to the direct contact, persons in direct touch with sick persons, or living in the same house. Indirect contacts were those persons who had called at the house, selling things or buying things, and these indirect contacts were kept under observation at home, and the inspector saw as far as possible to their revaccination, though in those circumstances it meant very little. But in the isolation home they could do very nearly as they liked in regard to revaccination. Indirect contacts could not be got to be vaccinated by hook or by crook; that was the drawback, but if it were possible to have measures carried out in the way of also isolating the indirect contacts they would be able to get vaccination thoroughly well done. But in the meantime there was no power to do it.

Dr. G. P. Johnson (Stoke-on-Trent) asked if it were not the fact that the English Local Government Board had advised that the isolation of contacts should not be carried out.

The Chairman replied that he was sorry to say they did; but in Newcastle they were not guided by that. In all they could isolate about 176 persons. The amount of cubic space was about 500 cubic feet each; this was not large, but then there were many slight cases among them.

Dr. J. Knight, in reply, said, with regard to the instance of a smallpox patient having continued at work with his fellow workers, if they could do so they narrowed down the issue of infection to the group of workers with whom the patient had been at work, and the same measures were carried out with them. But in the case of a patient having been employed in a factory at work which caused him to move about from one place to another, all they could do was to recommend revaccination. Nothing further than that was possible. Dr. Walford enquired the length of time of detention of those not previously vaccinated, and that was 14 days from the date of removal to the reception house, which would mean from 17 to 20 days from the initial exposure to infection. That would cover the incubation period. In cases where the patient was the only one not revaccinated, the contacts were only removed in order to have the clothing and house disinfected, and were then allowed at once to return home.

Dr. Wilson (Newcastle-on-Tyne) moved in accordance with notice "That this Congress is of opinion that the public health has suffered seriously through the transmission of smallpox by tramps, and recommends the council of The Sanitary Institute to petition Parliament to take such measures as will place vagrants under control, and reduce the risks of their disseminating infection."

This recommendation was carried.

SCARLET FEVER IN RELATION TO HOSPITAL ISOLATION.

A Report on the Recurrence of Scarlet Fever in Houses in Sheffield, during the Four Years, 1900—1903.

By F. H. WADDY, M.D., D.P.H.

SCARLET fever has been prevalent in Sheffield ever since the adoption of the Infectious Diseases (Notification) Act, and every three years the number of cases notified has attained a maximum. The following are the figures:—*

1890	2,202	1893	1,826	1896	2,002	1899	1,999	1902	1,601
1891	1,310	1894	832	1897	1,608	1900	1,794	1903	2,110
1892	1,448	1895	766	1898	1,493	1901	1,474		

Attention must be drawn in the first place to the increase in the size and population of the city during the year 1901, due to the addition of certain adjacent districts, as shown below:—

	1900.	1901 (*a*).	1901 (*b*).	1902.	1903.
Population*	376,160	382,334	410,991	418,765	426,686
Number of inhabited houses†		79,398	85,507	87,233	88,616

(*a*) Before October 31st. (*b*) After October 31st.

And so the increase in the prevalence of scarlet fever since 1901 is really not so great as it would at first sight appear to be. Yet the last year (1903) has afforded a real increase both in the prevalence of the disease and in the mortality, as shown in the following table:—

	1900.	1901.	1902.	1903.
Rate of incidence per 1,000 of the population*	4·77	3·82	3·82	4·95
Mortality „ „	·170	·147	·139	·232
Case Mortality, per cent.*	3·6	3·9	3·6	4·7

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*Taken from the annual reports of the Medical Officer of Health.

†The figures for 1901 are taken from the census returns. Those for 1902 and 1903 are derived from approximate estimates furnished by the Chief Assistant Overseer.

The increased prevalence during 1903 will be partly explained by the increase in the number of susceptible children during two years of diminished prevalence. The extent to which they increased during 1902 may be inferred from Table C, p. 796; and the diminution in their number during 1903 is also demonstrated.

No doubt the recent depression in trade has been another cause both of the increased prevalence of scarlet fever and of the higher mortality. One effect is evident in the greater density of the population. The following figures show that not only are people living closer together on the ground, but more people are living together in each house. And this condition is most noticeable in those houses which furnished the cases of scarlet fever.

	1900.	1901 (*a*).	1901 (*b*).	1902.	1903.
Average number of persons per acre *	19·1	19·5	17·4	17·7	18·0
„ „ „ inhabited house †	4·82	4·81	4·80	4·82	
„ „ in houses invaded by scarlet fever	5·547	5·684	5·765		

(*a*) Before October 31st. (*b*) After October 31st.

Seeing then that the average number of inmates per house has increased, we should expect to find a corresponding increase in the average number of cases of scarlet fever in the invaded houses (see Table A, p. 795). The figures more correctly expressed are 1·279 (1900), 1·284 (1901), 1·263 (1902), 1·290 (1903). These show that such an increase did occur during 1903; but that on the other hand there had actually been a large diminution in 1902. It is evident that an argument upon these grounds must not be pressed too closely.

The proportion of cases removed to hospital during 1903 was very much larger than in any previous year. And on this account the statistics for that year which are exhibited in the succeeding tables present certain points of difference from those of the preceding years. The details concerning the years 1900, 1901 and 1902 correspond closely with each other.

The state of affairs which existed during these three years is referred to in the following terms by the medical officer of health in his annual report for 1901.

> "For several years it has been necessary to draw attention to the insufficient accommodation provided at Lodgemoor Hospital for this disease.

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* Taken from the annual reports of the Medical Officer of Health.

† The figures for 1901 are taken from the census returns. Those for 1902 and 1903 are derived from approximate estimates furnished by the Chief Assistant Overseer.

> "The number of complaints received from medical men and parents in regard to this insufficiency has been even greater than in previous years, indicating the importance which they attach to the hospital isolation of cases occurring in cottage houses. Considerable discussion has taken place during the year as to the value of hospital isolation of scarlet fever as a means of preventing the spread of the disease. So far as Sheffield is concerned, there is no doubt whatever that the value of hospital isolation has been minimised by the fact that the majority of cases of scarlet fever are not removed to hospital at present."

This circumstance affords an explanation of the fact that the number of cases admitted to hospital has borne no constant relation to the number of cases notified; but it has varied from 54 per cent. one month to 36 per cent. the next (April and May) in 1900: from 39 per cent. (April) to 69 per cent. (May) in 1901; from 21 per cent. (March) to 53 per cent. (April) in 1903. The highest proportion was 71·4 per cent. in July, 1902, when the number of cases notified (91) in the month was much lower than the average; and the lowest was 20 per cent. in December, 1902, when the number of cases notified (164) in the month was unusually high.

In the accompanying chart, p. 800, the scales have been so arranged that if the proportion of cases admitted to hospital had been uniform, then the two lines would be exactly parallel. Since April, 1903, this condition has been approximately realised; but prior to that date the lines are never parallel for long together.

At the time of writing (June, 1904,) a proportion exceeding 80 per cent. is being maintained, and so next year we may be in a position to appreciate more completely the effects of unrestricted removal of patients to hospital.

But, granting that the system of removal to hospital was inadequately carried out, we yet hoped to see that it was to some extent efficacious as a preventive measure, and that it did confer an advantage with regard to non-recurrence upon those houses from which cases went to hospital over those in which patients were treated at home.

I must admit that I was amazed when I worked out the figures for 1900 to find that among those houses from which cases went to hospital there were no cases after the first in 76 per cent.; whereas among those in which cases were treated at home the proportion of non-recurrence amounted to 88 per cent.

It is seen from Table A, p. 795, that the respective proportions have been almost the same as these from year to year.

It was in order to investigate this astonishing result more minutely that I have undertaken the task of compiling further details year by year,

and it is the report of these investigations which constitutes the chief topic of the present paper, viz., the recurrence of scarlet fever in houses.

I ought here to acknowledge my obligation to Dr. Robertson, recently Medical Officer of Health for Sheffield, as well as to his successor, Dr. Scurfield, and to the members of the staff, who have courteously afforded me every facility in the compilation of statistics from the registers kept in the department, and in the preparation of the accompanying tables.

It is not possible to enter fully into a description of all the details to be observed, and the precautions to be taken, in order to ensure accuracy in computation. But a few points must be mentioned in order to guard against inferences being drawn from the figures which they really do not warrant.

The source of information in every case has been the report which the inspector makes on his first visit, and which is preserved in the form here shown.

.....*CASE.*

Copy of Printed Instructions left.....

Registration No.....

NAME..... AGE.....

ADDRESS.....

FAMILY. Adults Children. Lodgers Adults Children.

MEDICAL ATTENDANT, DR.....

First called in..... Notification received.....

HOUSE. New, about years old. Back to back. Through.
Good repair. Clean. Dry.
(.....Living rooms. .....Bedrooms. .....Cellars.)

YARD. Private. Common to houses. Condition as to soil pollution.....

WATER-CLOSET. Inside. Outside. Condition.....

PRIVY MIDDEN. Open. Covered. Drained. Leaking.
Wet. Foul. When last emptied.....

DRAINAGE. Surface. Rubble. Pipe. Tested. Not tested.
Gullies. Sumps.

WATER SUPPLY..... Cistern.....

MILK SUPPLY.....

OTHER FOODS.....

NUISANCES.....

BUSINESS CARRIED ON.....

LIBRARY BOOKS.....

Patient and Medical Attendant desire removal to Hospital.....

Isolated in Bedroom. Living Room. No Isolation.

Separate Attendant. Other duties of Attendant.....
Recent cases of Sore Throat .....
Other recent illness in house.....
Previous cases in same house or yard.....
Time of first feeling Sickness or Headache .....
Time of first appearance of Rash .....
Suspected source of illness.....
Date when previous cases returned from
Hospital in this or near houses.....

OCCUPANTS OF THE HOUSE.

Age M. F.	Name.	Place of Work or School and Standard.	Scarlet Fever History.*	Date of Rash.	Last at Work or School.

*A—Had Scarlet Fever. B—Not had Scarlet Fever. C—Now ill of Scarlet Fever.

NOTES.

.....Inspector.

The method I adopted was to make out a complete list of invaded houses for each year, distinguishing every case in them which went to hospital from the cases that remained at home.

Every case notified during the year was recorded, and if in any house another case occurred up to March 31st of the following year, that was recorded also.

The houses presenting only one case were readily computed, and a second list was drawn up comprising all the others.

With regard to the cases occurring in them, the question of priority had next to be determined; and invariably the date of the case was regarded as being the date of the onset of illness, namely, the day when the earliest symptom of scarlet fever was observed, or the date of the eruption when no symptom preceded it.

Cases taken ill on the same day were classified as simultaneous, and either was considered prior to the other. Every case subsequent to then first in each house has been considered as secondary to the case next preceding it provided, of course, that such preceding case was notified during the year under consideration.

For instance, if a patient was taken ill say on the 1st day of August, and others in the same house on the 6th, 7th and 8th, then the case on the 6th has been regarded as secondary to that on the 1st, the case on the 7th secondary to that on the 6th, the case on the 8th secondary to that on the 7th.

It must accordingly be understood that the term secondary thus applied possesses no etiological signification whatever. Its import is merely chronological. It implies nothing more than occurring next in order of time.

In defence of this principle of nomenclature must be urged the impossibility of arranging the cases in their order of *infection*, the period of incubation being variable, and the source of infection being often unknown.

To attempt any such etiological arrangement of the cases would introduce an element of speculation, whereas the chronological system can be carried out with absolute precision. Moreover, it will be seen later on that from a statistical standpoint the system furnishes a perfect basis for the comparisons about to be instituted.

The figures in Table A, p. 795, refer to the events which followed primary cases only. But our investigation on this point ought perhaps to take into account those houses from which not the first but some subsequent case was removed to hospital, or not removed. And so I prepared separate lists of such houses, and the proportion of non-recurrence in each group after including these is shown in Table F, p. 798. The proportions do not differ appreciably from those shown in Table A.

The fact that success in preventing the recurrence of scarlet fever has been attained to a less degree in the one group of houses than in the other, led me to institute comparisons between them in other respects.

In order to discover what grounds of difference exist between the two groups of houses, investigations were made with regard to three conditions in particular :—

1. The number of inmates. 2. The number of rooms. 3. The susceptibility of the inmates with regard to scarlet fever.

The results are shown in Tables B & C, pp. 795–6.

From these it appears that in every respect the houses from which cases were removed to hospital constitute an inferior class to those in which cases were treated at home. The number of inmates is greater, and a larger proportion of these are children. The number of rooms, and particularly of bedrooms, is less, the average number of persons per room being about one-fifth as great again in the one group as in the other during 1901 and 1902.

One important circumstance must not be overlooked. The removal of the patient to hospital confers on each house temporarily* an advantage

* The average duration of the patient's stay in hospital was 58·3 days.

with regard to accommodation which places the "hospital" houses on an equality with those in which cases were treated at home. The average number of persons per house becomes actually less than it is in the "home" group; and the average number of persons per room is reduced to 1·05 (1901), 1·06 (1902), and 1·16 (1903).

In Table B no account is taken of this circumstance.

But it is in the matter of susceptibility of the remaining inmates that the disparity between the two groups of houses becomes more conspicuous. The susceptible children, for instance, constituted (in 1901 and 1902) one third of the whole households in houses from which cases were removed to hospital, but only one fourth in houses in which cases were treated at home. The susceptible children left in the home after each instance of scarlet fever were nearly half as many again, and the homes without any susceptible children left were only half as frequent in the one group as in the other.

If the number of persons at all ages who are said not to have had scarlet fever be taken into account, the disparity between the two groups does not appear so great; but the inferiority of the houses in the hospital group is manifest, though to a less degree.

A close comparison of the figures for 1903 with those of the preceding years discloses the fact that the conditions in the two groups of houses differ from one another more widely in 1903 than previously. This circumstance is explained by the larger proportion of removals to hospital that year. This has had the effect of transferring what would have been the worst houses in the home group into the hospital group, thus raising the average standard of one at the expense of the other.

We might, therefore, expect to find a corresponding alteration in the proportion of recurrence in the two groups.

Table D shows that alterations of this nature have been taking place. They are more noticeable in the items which concern recurrence among persons at all ages than in those which concern children only.

With regard to the proportion of susceptible children who afterwards took scarlet fever, the differences are not great; the proportions range from 11·4 to 13·3 per cent. of recurrence.

But when we take into account the total recurrence in houses among persons at all ages, we see a distinct and increasing advantage on the side of the home group of houses.

The latter half of Table D, p. 796, does not deal with the number of susceptible persons themselves, but with the number of instances which presented

them. From this point of view the advantage on the side of the home group becomes all the more conspicuous.

A simple illustration will explain this distinction, and the effect which it has on the statistics.

Let us suppose that in a family comprising six susceptible persons a case of scarlet fever occurs, and at the same time a case occurs in a family comprising five susceptible persons. We will suppose that after a while one more case occurs in each family, and after that no more. Each family has suffered from one instance of recurrence, but in the case of the larger family this one has affected one person out of five remaining after the first case, *i.e.*, 20 per cent., whereas in the smaller family it has affected one out of four remaining, *i.e.*, 25 per cent.

In my opinion we obtain a more accurate basis for comparing the degree of recurrence by considering proportions of instances than by considering proportions of persons; because the larger families must have more instances of recurrence in order to attain the same proportion of cases as the smaller families. We have already seen (Table B) that the hospital group consists of houses containing an average of six persons, and the home group an average of five persons.

I suggest that this is a statistical detail which has not hitherto received due consideration in certain annual reports.

The fact is that for certain purposes we have to count instances, for other purposes individuals, just as in the preceding tables we have sometimes counted houses, sometimes cases. This renders the preparation of the tables a very complicated task, and increases the difficulty of making the columns balance. For example, an instance may consist of a solitary case, or of two or three simultaneous cases. Of these simultaneous cases perhaps one goes to hospital while two remain at home; and so that house has to be counted once in each category. There have been a few instances in which the same patient took scarlet fever a second time a few months after a former attack. One case was registered which having been notified twice had been inadvertently counted a second time. This might have been dealt with as two solitary cases; but unfortunately the first time the child had fever she died.

The questions with which we are now confronted are these:

1. Is the preponderance of recurrence in the hospital group of houses in direct proportion to the inferiority of the conditions they present; or is it greater or less than this proportion?

2. What other conditions may there be besides those of accommo-

dation and air space which would affect the recurrence in one group more than in the other?

3. Ought we to attribute to the hospital any influence whatever upon the degree of recurrence?

The first point may be settled by the exercise of a little more arithmetic. We see (Table D, p. 796) that in 1902 there were, among children in the home group of houses, 123 instances of recurrence out of 587 possible, a proportion of 21 per cent. Let us suppose that in the hospital group of houses the children who actually went to hospital had remained at home. Then if we surmise that the probability of other cases occurring would be in direct proportion to the number of susceptible children remaining after each instance, because each presents a fresh avenue for infection either from within the infected house itself or from without, and if we further surmise that the probability would be at the same time proportionate (inversely) to the accommodation (especially the sleeping accommodation) in the houses, because the closer proximity promotes infection, we should expect the instances of recurrence among children in the hospital group to number

$$123 \times \frac{564}{587} \times \frac{188}{128} \times \frac{227}{194} = 201 \text{ instances.} \quad \text{(See Tables B \& C.)}$$

a proportion amounting to nearly 36 per cent. In actual fact the recurrence amounted to 152 instances, a proportion of 27 per cent.

But the children (under 15) are not the only patients; and they constitute in point of numbers only the smaller half of the household. Taking all the cases into consideration and all the susceptible inmates, we find that the recurrence in the home group of houses amounted to 145 out of 852 possible instances, a proportion of 17 per cent., and so, making the same assumptions as we did before, we should anticipate in the hospital group a recurrence amounting to

$$145 \times \frac{675}{872} \times \frac{410}{341} \times \frac{227}{194} = 161 \text{ instances.}$$

a proportion of nearly 24 per cent. In fact the recurrence amounted to 173 instances, a proportion approaching 26 per cent.

Similarly for the year 1903, the recurrence among children (under 15) would work out at 452 instances = 42 per cent., as against the recurrence in 297 instances = 27 per cent.

And the recurrence among susceptible persons (at all ages) would

work out at 322 instances = 24 per cent., as against the actual recurrence in 334 instances = 25 per cent.

The inferences are inevitable. Although there is a great advantage on the side of the hospital group of houses in respect of recurrence among children (under 15), yet when all the cases are taken into consideration, the houses from which patients are removed to hospital are found to be worse off in respect of recurrence than the other houses, not only in simple proportion to their worse conditions, but to a degree exceeding that proportion.

Still, it would be wrong to assert that this excess was due to the system of removing patients to hospital. Perhaps there remain yet other conditions which have not been allowed for; or perhaps those for which allowance has been made exercise an influence greater (or possibly lesser) than that of simple proportion.

It will no doubt be contended (and justly) that many of the cases which occur only one or two days after another are not really instances of recurrence at all, but are in point of fact cases infected at the same time and from the same source as the patient who became ill first.

Unfortunately we cannot determine which are the cases that ought to be regarded in this light. Nor for the purpose of my argument does it matter whether we can or not. I have never alleged that one case was the cause of another. What I have proved amounts to this, that the manner in which the earliest case has been dealt with has not prevented the occurrence of the later cases.

The remaining Tables E and F, pp. 787-8, furnish statistics which show how far this question of inevitable recurrence affects our conclusions.

Results have been determined with reference to a period of seven days after the removal of the previous case. The proportion of instances in which this inevitable recurrence has taken place has gradually diminished during the three years from more than 17 to less than 16 per cent. And a still greater diminution is noticeable in 1903 in the proportion of those instances in which another case became ill before the previous case was removed.

This diminution must be ascribed to the unrestricted facilities for the removal of cases to hospital, whereby the delay which previously occurred is now greatly curtailed. And it shows that what has been termed inevitable infection is not altogether inevitable.

For the sake of convenience I have included in the same Table E a statement of cases which occurred, during each successive period, next after the return of a previous case from hospital. Some of the intervals

amounted to 200 or 300 days, and probably in many of these instances the latter case was not due to the former. The etiological aspect of this question is a separate subject. It does not affect the statements of fact in Table E, which bear precisely that signification and no more than that, which is assigned to them. Whatever the cause of it may have been, the fact remains that cases following the return of a previous case from hospital have occurred in a larger proportion of instances during 1903 than ever before.

The degree of early and late recurrence year by year is worked out more fully in Table F. I adopted the limit of 12 days between the onset of illness in successive cases because I found on examination that on an average that limit coincided in the hospital group of houses with the limit already adopted of seven days after the removal of the previous case.

In the earlier years I worked out the proportions with regard to houses only, and I found that whereas the proportion of houses with early recurrence in the hospital group (15 per cent.) was half as great again as the proportion in the home group (10 per cent.), yet with regard to late recurrence the proportion in the former group (12 per cent.) was twice as great as the proportion in the latter.

The fact is also noticeable, whatever may be the cause of it, that the year 1903 presents almost the highest proportion of houses with *late* recurrence in the hospital group, while the proportion in the home group is by far the lowest. The circumstances detailed at the outset may partly account for this; but at the same time it must be observed that the proportion of houses presenting *early* recurrence is somewhat less in both groups in 1903 than it was in 1902.

But if the merits of the hospital system are to be called in question, as indeed some persons have recently called them in question, then, as I have already intimated, we shall find a fairer basis of comparison in a consideration of the number of instances of recurrence than in that of the number of houses in which they occurred.

This will show the results for 1902 in a different light. The ratio between the two groups of houses with regard to early recurrence was 15·8 : 9·9, or rather more than half as great again; while with regard to late recurrence the ratio was 9·3 : 6·6, or rather less than half as great again.

For the year 1903, on the other hand, the ratio with regard to early recurrence was 14·3 : 10·2, or rather less than half as great again; while with regard to late recurrence the ratio was 10·3 : 4·45, more than twice as great.

We see then that whereas in the home group of houses the liability to recurrence diminished as time went on from 10 per cent. (early) to 5 per cent. (late), *i.e.*, by half, yet the liability in the hospital group diminished only from 14 per cent. (early) to 10 per cent. (late) of instances, or 12 per cent. of houses, *i.e.*, by about a quarter.

This result is the more surprising when we reflect that during a period averaging 58 days the principal source of infection is absent from the hospital houses.

At Dr. Scurfield's suggestion I have worked out the proportion of recurrence before and after several other periods later than 12 days in the two groups of houses. The results are shown in Table G and the notes attached to it; and they are depicted graphically in Chart II., p. 801.

In the computation of late recurrence we have simply left out of count the instances of early recurrence. Supposing that by administrative measures all these latter could be prevented, and their number added to that of instances in which no case followed, then the difference between the results in the two groups of houses would prove to be such as is shown on the last line of Table F. There would be no recurrence in 88 per cent. of houses from which cases went to hospital and in 94 per cent. of houses in which cases were treated at home.

We have by no means exhausted the comparisons which the statistics suggest. But they have been handled sufficiently to prove that during the last four years the hospital system in Sheffield has not been successful in preventing the spread of scarlet fever. Nevertheless, the success might possibly have been less under any other system.

This paper has dealt only with the recurrence of scarlet fever in houses. No one will call in question the benefit conferred upon a general hospital, or an industrial school, by removing to the fever hospital a patient who never returns to the former institution. And if the hospital existed for no other purpose than this, its utility would not be called in question. Nor has any reference been made to its merits as a nursing institution and a convalescent home. It is solely with the results of the system as a preventive measure that my calculations have been concerned.

REFERENCES.—1. Up to March 31st of the following year.
2. Persons who are said not to have had Scarlet Fever are regarded as susceptible.
3. The instances available for consideration in 1901 consisted of an alphabetical series which comprised about one-fifth of all the cases notified. In 1902 and 1903 they included every case except the few which occurred in public institutions, &c., where the susceptibility of the inmates to Scarlet Fever could not be ascertained.

TABLE A.—*Comparing successive years with regard to the recurrence of Scarlet Fever in houses.*

	1900.	1901.	1902.	1903.	1903.*
Number of cases notified...	1794	1474	1601	2110	2069
Number of houses involved	1403	1148	1267	1636	1627
Average number of cases per house	1·28	1·28	1·26	1·29	1·27
Number of cases removed to hospital	777	769	716	1412	1371
Proportion of „ „ „	43·3 %	52·2 %	44·7 %	66·9 %	66·0 %
Number of houses from which cases were removed to hospital	605	577	559	1078	1069
Proportion of „ „ „ „ „ „	43·1 %	50·3 %	44·1 %	65·9 %	65·7 %
Number of houses in which primary cases only occurred	1168	920	1017	1287	1286
Proportion of „ „ „ „ „	83·2 %	80·1 %	80·3 %	78·7 %	79·0 %
Number of houses from which primary cases were removed to hospital...	593	567	544	1065	1056
Number of such houses in which no case followed[1]	452	425	413	799	798
Proportion of „ „ „ „	**76·2 %**	**74·6 %**	**75·9 %**	**75·0 %**	**75·6 %**
Number of houses in which primary cases were treated at home ...	810	582	723	573	573
Number of such houses in which no case followed[1]	716	496	604	490	490
Proportion of „ „ „ „	**88·4 %**	**85·2 %**	**83·5 %**	**85·5 %**	**85·5 %**

* Excluding 41 cases which occurred in 9 public institutions.

TABLE B.—*Comparing the conditions existing in houses (at the time of notification of the primary case).*

	Houses from which any case went to hospital.			Houses in which any case was treated at home.		
	1901.	1902.	1903.[3]	1901.	1902.	1903.
Average number of persons per house	6·0	6·0	6·0	5·0	5·4	5·2
Proportion of children to total inmates	49·0 %	49·4 %	52·1 %	46·0 %	46·1 %	44·4 %
Average number of rooms per house	4·73	4·71	4·34	5·04	4·88	5·00
„ „ persons per room	1·31	1·27	1·39	1·0	1·12	1·05
„ „ „ „ bedroom	2·22	2·27	2·36	1·8	1·94	1·85

TABLE C.—*Comparing houses with regard to the susceptibility[2] to Scarlet Fever of the inmates remaining (after each case notified).*

	In Houses from which Cases were Removed to Hospital.			In Houses in which Cases were Treated at Home.		
	1901.	1902.	1903.[3]	1901.	1902.	1903.
Proportion of inmates constituted by susceptible[2] children (under 15)... ...	36·4%	31·4%	30·3%	27·8%	23·6%	20·5%
Average number of susceptible[2] children remaining after each instance ...	1·73	1·83	1·83	1·20	1·28	1·07
„ „ „ persons (at all ages) „ „ ...	4·37	4·10	3·94	3·24	3·41	3·16
Proportion of instances in which some susceptible[2] children remained... ...	82·1%	81·7%	79·3%	64·4%	66·9%	62·1%
„ „ „ „ „ persons (at all ages) „	100·0%	97·7%	98·2%	96·2%	97·0%	97·0%

TABLE D.—*Showing the conditions existing in houses after the occurrence of each case.*

	In Houses from which the Case was Removed to Hospital.			In Houses in which the Case was Treated at Home.		
	1901.	1902.	1903.[3]	1901.	1902.	1903.
Number of instances available for consideration[3]	140	690	1,360	132	878	697
Number of susceptible[2] children (under 15) who remained	243	1,295	2,496	158	1,127	749
„ „ „ „ took Scarlet Fever	29	155	306	21	129	86
Proportion „ „ „ „ „	11·9%	12·0%	12·3%	13·3%	11·4%	11·5%
Number of susceptible[2] persons (at all ages) who remained	312	2,829	5,365	428	2,995	2,204
„ „ „ „ took Scarlet Fever	36	176	343	23	151	105
Proportion „ „ „ „ „	5·9%	6·2%	6·4%	5·4%	5·0%	4·8%
Number of instances in which some susceptible[2] children remained	115	564	1,079	85	587	433
„ „ „ „ „ took Scarlet Fever ...	29	152	297	21	123	83
Proportion „ „ „ „ „ „ ...	25·2%	27·0%	27·5%	24·7%	21·0%	19·2%
Number of instances in which some susceptible[2] persons remained	140	675	1,336	127	852	676
„ „ „ „ „ took Scarlet Fever ...	36	173	334	23	145	102
Proportion „ „ „ „ „ „ ...	25·7%	25·6%	25·0%	18·8%	17·0%	15·1%

TABLE E.—*Comparing successive years with regard to the recurrence of Scarlet Fever in houses before the removal of the primary case to hospital, and after the return of the primary case from hospital.*

	1901.		1902.		1903.	
		Proportion %		Proportion %		Proportion %
Patients were removed to hospital in	755 instances	...	703 instances	...	1348 instances	...
Patients were removed to hospital from	577 houses	...	559 houses	...	1069 houses	...
Secondary cases *became ill not later than seven days after* the removal of the previous case in	131 instances	17·4	121 instances	17·2	215 instances	15·9
Secondary cases *became ill not later than seven days after* the removal of the previous case in	95 houses	...	91 houses	...	170 houses	...
Secondary cases *had already become ill before* the removal of the previous case in	99 instances	13·1	95 instances	13·7	146 instances	10·8
Secondary cases *had already become ill before* the removal of the previous case in	78 houses	...	74 houses	...	121 houses	...
Secondary cases *followed*[1] *the return* of the previous case from hospital in	44 instances	5·8	36 instances	5·1	79 instances	5·9
Secondary cases *followed the return* of the previous case from hospital in	44 houses	...	35 houses	...	77 houses	...
Secondary cases *followed within twenty-one days of the return* of the previous case from hospital in	31 instances	4·1	20 instances	2·8	57 instances	4·2
Secondary cases *followed within twenty-one days of the return* of the previous case from hospital in	31 houses	...	20 houses	...	56 houses	...

TABLE F.—*Comparing the degree of Early and Late Recurrence*[1] *in Houses.*

	In Houses from which a Case was Removed to Hospital.						In Houses in which a Case Remained at Home.					
	1901.		1902.		1903.		1901.		1902.		1903.	
(A) Number of instances under consideration[3]	...	Proportion % ...	690	Proportion % ...	1360	Proportion % ...	...	Proportion % ...	878	Proportion % ...	697	Proportion % ...
(a) Number of houses under consideration	577	...	542	...	1058	...	599	...	740	...	600	...
(B) No cases followed[1] in	...	...	517 ins.	74·9	1026 ins.	75·4	...	...	733 ins.	83·5	595 ins.	85·4
(b) No cases followed in	434 ho.	75·2	410 ho.	75·6	799 ho.	75·5	511 ho.	85·3	618 ho.	83·4	511 ho.	85·2
(C) Some case followed[1] in	...	...	173 ins.	25·1	334 ins.	24·6	...	...	145 ins.	16·5	102 ins.	14·6
(c) Some case followed in	143 ho.	24·8	132 ho.	24·3	259 ho.	24·5	88 ho.	14·7	123 ho.	16·6	89 ho.	14·8
(D) Recurrence[1] was early (up to 12 days) after	...	...	109 ins.	15·8	194 ins.	14·3	...	...	87 ins.	9·9	71 ins.	10·2
(d) Recurrence was early (up to 12 days) in	...	...	82 ho.	15·1	153 ho.	14·5	...	...	77 ho.	10·4	62 ho.	10·3
(E) Recurrence[1] was late (after 12 days) after	...	...	64 ins.	9·3	140 ins.	10·3	...	...	58 ins.	6·6	31 ins.	4·4
(e) Recurrence was late (after 12 days) in	73 ho.	12·6	63 ho.	11·6	131 ho.	12·4	37 ho.	6·2	55 ho.	7·4	31 ho.	5·2
(f) Recurrence[1] was early only in	70 ho.	12·1	69 ho.	12·7	128 ho.	12·1	51 ho.	8·5	68 ho.	9·2	58 ho.	9·7
(g) Recurrence[1] was late only in	...	...	50 ho.	9·2	106 ho.	10·0	...	...	46 ho.	6·2	27 ho.	4·5
(h) Sum of *(b)* and *(f)*	504 ho.	87·3	479 ho.	88·4	927 ho.	87·6	562 ho.	93·8	686 ho.	92·6	569 ho.	94·8

TABLE G.—*Comparing the extent of recurrence in houses at specified periods. The proportions express the ratio between the number of instances in which there was recurrence (as specified) and the total number of instances in the group.*

The intervals are reckoned from the onset of illness of one case until the onset of illness of the case next following.	In houses from which cases were removed to hospital.						In houses in which cases were treated at home.					
	1901.		1902.		1903.		1901.		1902.		1903.	
	Instances.	Proportion Per cent.	Instances.	Proportion Per cent.	Instances.	Proportion Per cent.	Instances.	Proportion Per cent.	Instances.	Proportion Per cent.	Instances.	Proportion Per cent.
Number of instances available for consideration	717	...	690	...	1360	...	685	...	878	...	697	...
Recurrence later than 200 days.....	2	·28	6	·87	5	·37	1	·15	4	·46	2	·29
„ „ „ 150 „	5	·70	11	1·6	6	·44	4	·58	6	·68	3	·43
„ „ „ 80 „	16	2·2	20	2·9	21	1·5	7	1·0	8	·91	6	·86
„ „ „ 50 „	43	6·0	26	3·8	72	5·3	14	2·0	12	1·4	10	1·4
„ „ „ 30 „	55	7·7	45	6·5	89	6·5	18	2·6	18	2·1	15	2·2
„ „ „ 14 „	75	10·5	58	8·4	133	9·8	37	5·4	50	5·7	30	4·3
„ „ „ 12 „	78	10·9	64	9·3	140	10·3	42	6·1	58	6·6	31	4·4
„ earlier than 12 „	122	17·0	109	15·8	194	14·3	72	10·5	87	9·9	71	10·2
Total recurrence (*i.e.*, on the next day or later).....	200	27·9	173	25·1	334	24·6	114	16·6	145	16·5	102	14·6

The proportion of instances with recurrence

Up to 12 days was half as great again in the Hospital group as in the Home group ... ... viz. 15 : 10
Later than 14 days was twice as great „ „ „ „ ... ... „ 10 : 5
„ 30 „ three times as great „ „ „ „ ... ... „ 6·6 : 2·2
„ 50 „ „ „ „ „ „ „ ... ... „ 5·0 : 1·6
„ 80 „ twice as great „ „ „ „ ... ... „ 2 : 1
Between the 30th and 80th days was three times as great in the Hospital group as in the Home group in 1901 ... ... „ 5·4 : 1·6
„ „ „ „ „ „ „ „ „ in 1902 ... ... „ 3·6 : 1·1
„ „ „ nearly four times as great „ „ „ „ in 1903 ... ... „ 5 : 1·3

These differences are exhibited graphically on Chart II.

CHART I.

To show how the Accommodation for Scarlet Fever at the Hospital varied from month to month prior to April, 1903.

The Scales on this Chart are so arranged that if the *proportion* of cases admitted to hospital had been uniform, the two lines would be parallel.

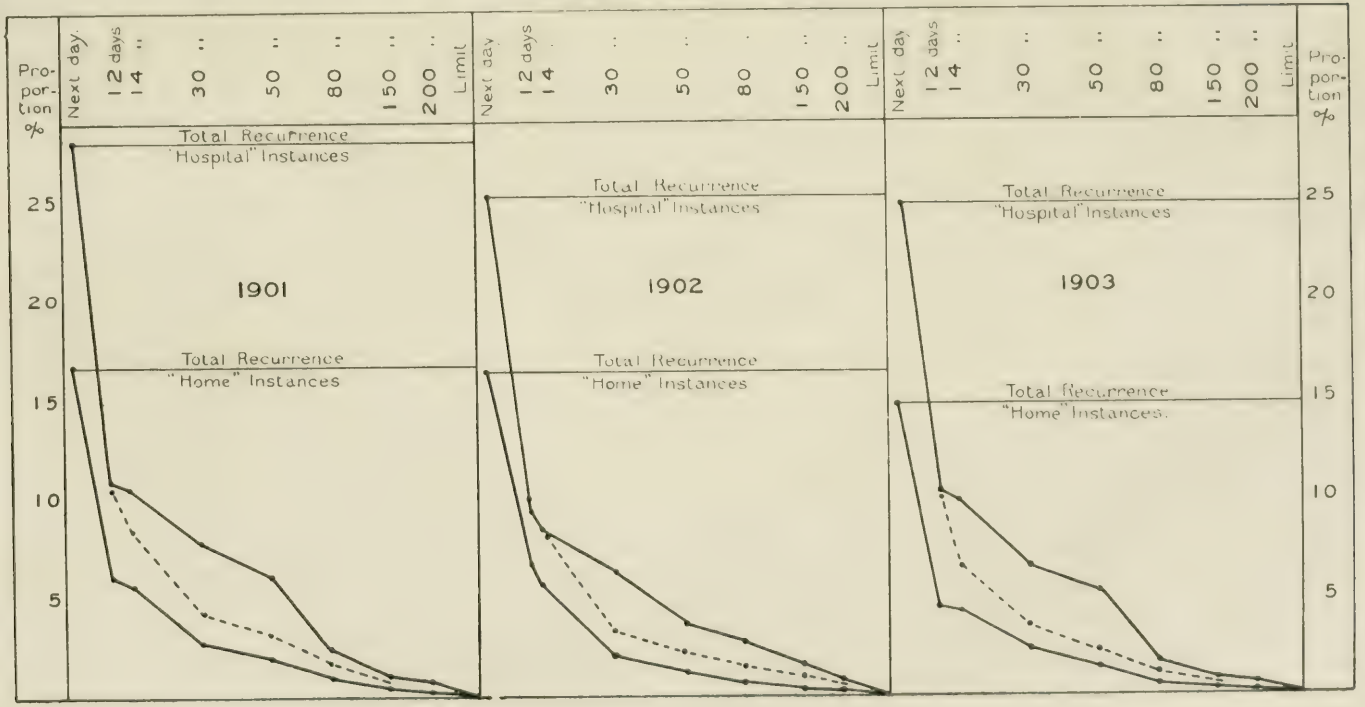
The period after April, 1903, is separated from that preceding it.

CHART II. (to illustrate Table G). Expectation of recurrence.

The oblique lines indicate the diminishing liability to recurrence at successive periods in the two groups of houses.

The recurrence up to the time specified is measured by the space above the oblique line up to the level of total recurrence.
" " later than " " " " " below " " " down to the base line.
" " during each interval " " " " difference in attitude of successive dots.

If the liability to recurrence diminished at the same rate in the two groups of houses, then the two oblique lines would converge continuously toward the base line (as shown by dots). But the fall in each line for the "hospital" group is retarded after the 14th day, the divergence being greatest about the 50th day, and most marked in 1903.



Dr. Robertson (Birmingham) said that he had been associated with Dr. Waddy for a good part of the time that Dr. Waddy had been doing this work in Sheffield, and he was very much interested in what he thought was a piece of reliable and very valuable statistical work. What he believed led up to this investigation was a fact that most of them would agree to: *i.e.*, that they often got scarlet fever patients treated in artizans' houses and in court-yards, where they had got susceptible children in the house, and 30 or 40 susceptible children in the courtyard, all packed together, the case of scarlet fever was not recognized till the third or fourth week, and yet they got no recurrence of it. This inability to infect was very marked. He was very glad that Dr. Waddy had taken up this investigation, to try and find out whether a hospital really did prevent second cases occurring in a house. It was almost impossible to do justice to Dr. Waddy's statistics in any discussion. He had stated he had at his disposal good material for his purpose, because they had in Sheffield taken particular care to get accurate records of every case of scarlet fever. Dr. Waddy had taken an extreme amount of trouble, and if these deductions were accurate the point he had arrived at was that they did not quite know at the present time how scarlet fever was transmitted from one person to another. It was rather a remarkable fact that, after a century's work, there were certain influences at work in spreading scarlet fever which were still apparently unknown. They did not know all, and recognising that they must not attempt to lay down any irrevocable rules for the work.

Dr. Brownlee (Glasgow) said Dr. Robertson's remarks had interested him very much, and he had come to the same conclusion, namely, that the way in which scarlet fever was spread was quite unknown. In 50 to 60 per cent. of the cases in Glasgow there was practically not a single particle of evidence of people having had infection from anybody else. Further there was no evidence in Glasgow at all that scarlet fever was spread by schools, the age distribution being exactly the same among the cases occurring during the holidays as among those after the schools take up in the autumn. In the second place the spread by direct infection from person to person accounted for only a small proportion of the actual cases occurring. In its spread it resembles considerably enteric fever, being an autumnal disease occurring more prevalently in warm years than in cold years. Dr. Waddy's last table bore out how the infection lingered, especially in the poorer localities, in and around the houses where it had occurred, the tailing off, as week after week passed, bearing a close resemblance to the natural decline of an epidemic. He had noticed when employed in the sanitary office in Glasgow, that when a thaw occurred immediately after some weeks of frost, there was frequently a recrudescence of scarlet fever, and that among these cases no two patients were at the same school or had the same milk supply, or had any connection with other fever patients. In conclusion isolation of scarlet fever

could not be expected to produce immediate results, as even a disease such as typhus, which they knew the means of combating with almost mathematical certainty, took two of Glasgow's most eminent medical officers, Sir William Gairdner and Dr. Russell, a matter of 20 years to exterminate.

Dr. Willoughby (Eastbourne) said that the question of the treatment of scarlet fever in hospitals in reference to the expenditure of public money was becoming very important indeed, and the remarks of the last speaker with regard to the uses of the hospital were most important. With regard to the statistics of Dr. Waddy he did not think he had laid sufficient stress on the fact that the cases removed to hospital were the cases removed from houses where recurrence was most likely to take place from the impossibility of completely disinfecting, and from the constant meeting of the other children with those who might have brought the disease in the first case. The cases at home were in the best class of houses with the best accommodation, and with the fewest children. They made excuse for non-removal because the children were not mixing up with others. There was another fallacy in these statistics due to the fact that such a small proportion of the cases in Sheffield were isolated. He had had the advantage of the isolation of 90 to 100 per cent. of cases of scarlet fever in hospital, and he knew that the cases that had remained at home provided a very undue proportion of the cases that had to come to the hospital afterwards. That fact made the statistics not so important as they seemed. They did not get the total number of cases much reduced, for they found that in Eastbourne they got a large number of cases brought into the town from London, as they received quite 30,000 visitors from London all the year round.

Dr. Campbell (Gloucester) said that he had also been experimenting, and his experience was rather contrary to Dr. Willoughby's. He had isolated very nearly 100 per cent. of the cases, but he found that there were circumstances that one could not very well account for, that falsified all his trouble. At the present time he had a small epidemic of scarlet fever. For years he had isolated every case that he could get into the hospital, and that would amount to about 90 per cent. of the cases. How it was to be accounted for he did not know, but he had some ideas on the subject. His was an expensive hospital, but the hospital isolation had not been as successful as he had expected, and he would like to ask some one what period he considered was a safe period to retain cases in hospital to make sure that that case when it went home did not cause a recurrence in the house. He had found also that people would not give up the whole of their clothes for disinfection, and there were other circumstances which might tend to increase the number of cases in the house after the case went home. He had seen a good many return cases, but there must be other circumstances which caused the peculiar incidence of scarlet fever under certain con-

ditions that prevented the hospital dealing with it as one would expect for the expenditure of money. His idea was that scarlet fever at present was so extremely mild that it was not recognised, and that the parents did not send for a medical man in time, but allowed their children to go to school with the result that a great many cases were transmitted in that way. They might do what they liked with hospital accommodation, but he did not think they would prevent these peculiar visitations. The mildness of scarlet fever at the present time accounted for the big increase at certain times.

Dr. Wheatley (Shrewsbury) said that he had all along advocated that it was the duty of medical officers to draw up some form by which these statistics might be made comparable. He did not know whether it was possible for Dr. Waddy to compare scarlet fever in houses of one class sent to hospital with cases and in houses of the same class left at home.

Dr. Scurfield (Sheffield) said he would like to endorse what had been said by Dr. Wheatley as to the desirability of all medical officers of health going carefully into this matter, and working out statistics for their several districts as Dr. Waddy had done. He did not wish to draw any conclusion from the experience of Sheffield, because that was only one series of statistics. The condition of the houses had been carefully gone into, and Dr. Willoughby would see the particulars in Table B. It was extremely difficult to discuss a paper like this, but in going through the paper carefully he thought he had found out some fallacies, and he had discussed the matter with Dr. Waddy, when he found that his supposed fallacies did not exist. That made him more emphatic in endorsing what Dr. Wheatley had said as to the necessity for each man for himself going into the matter for his own district. His strong belief was that the Sheffield hospitals were as well managed as any in the kingdom, and he was able to say that as an unbiassed speaker, because he had nothing to do with their management, nor had his predecessor, Dr. Robertson. He thought it was pretty well recognised that return cases had nothing to do with the length of stay in hospital. The cause seemed to be the infection of the air passages.

Dr. Vacher (Cheshire C.C.) said that he sincerely trusted that any statement made by Dr. Waddy would not lead the junior medical officers of health to doubt the utility and necessity of infectious hospitals, more especially hospitals for scarlatina. In his own county, which was largely a dairy county, they could not doubt it. There was a regulation made by certain firms, who contracted for the supply of milk, that, on the occurrence of scarlatina in the farm, or among the people employed on the dairy farm, the matter should be reported. Then the local inspector made a visit, and, if an arrangement was made to send the patient to a scarlatina hospital, the man was entitled to continue his contract, after he lost the one day. If this accommodation was not made available, the dairyman would be face to

face with the temptation not to report a case, an action at law would be the result, and much trouble would ensue which would be avoided by having a sufficient number of isolation hospitals in the county.

Dr. G. P. Johnson (Stoke-on-Trent) said that Dr. Newsholme had laid it down that it was unreasonable to assume that the isolation of scarlet fever patients would have no effect in reducing the number of cases in a great many instances. They could not have too many statistics. He would like to give a few statistics from Stoke-on-Trent. During the last ten or twelve years, from 1891 to 1900, the number of cases varied from between 400 and 500 to something like 110, the lowest. During those years very little was done in the way of removal to hospital. In the year 1900, when he became medical officer of health, he advised his authority to remove as many cases as possible, and in addition to that to make use of every other means in the way of disinfection to control the disease. Before 1900 the number of cases removed averaged not more than 15 or 16 per cent., whereas in 1900, 65 per cent. were removed, in 1901, 66 per cent., in 1902, 77 per cent., and in 1903, 62 per cent. In addition to that of course very stringent measures were taken to keep the children away from school, and disinfection and every other means that they could think of were carried out; it was quite unreasonable to suppose that isolation alone would largely reduce the number of cases. They must adopt every means possible. The result was that in 1901 the number of cases was 97, in 1902, 57, and in 1903, when they had an epidemic, there were 155. From these statistics, after making allowance for the permanence of scarlet fever, he thought one was bound to conclude, that by adopting all measures and thorough disinfection they could to some extent reduce the number of cases occurring.

Dr. Butler (Willesden) said that the investigation which Dr. Waddy had made on that very important subject was an example to be followed in many other directions. There was one important point, however, in the statistics presented, to which he desired to call attention, and that was the comparison of the home treated and hospital treated cases was not exactly, and could not be, a fair one. The cases that were treated at home were the cases that had the best hygienic conditions, and the cases that were sent to hospital, *ipso facto* were cases selected from homes where the conditions were especially conducive to the spread of the disease, so that they would naturally expect amongst those cases that were removed to hospital a greater proportion of spread than amongst those treated at home. That was sufficient in itself to account for the difference in the proportion of the return cases occurring. In his own district during the last two years he had investigated every house in which two or more cases of scarlet fever had occurred, and there was a somewhat greater incidence of returns among those removed to hospital than among those treated at home, and in that respect his experience agreed with Dr. Waddy, but he had been far from satisfied that

that was due to the fact of aggregation in hospital. He did not, in fact, think that the hospital had anything to do with the occurrence of return cases, and he did not think that the way to prevent recurrence was by passage of the patients through convalescent homes. That was a practice that rested on the assumption that the infection was conveyed from association with other cases; but for this assumption there was, in his opinion, at present no evidence.

The Chairman (Dr. H. E. Armstrong, Newcastle) said it had been his firm conviction that repeated cases in a house were due to some circumstances that they had not yet got a hold of. The name "scarlet fever" was a misleading one, and there was scarlet fever indeed which was neither scarlet nor fever at a certain period of its existence. They did not sufficiently understand the rôle played by the flea, but when typhus in the old days was so prevalent the flea had probably more to do with the spread of the disease than anything else. They knew how difficult it was to distinguish between the flea bites and fever marks in certain circumstances. There was a means of distinguishing, which he need not go into, but the flea had always appeared to him to be a means of conveying infection in typhus, and possibly also in scarlet fever, just as the mosquito appeared to be in other fevers. It was very difficult indeed to get people to give up everything to be disinfected. He had known of cases where dresses had been put away accidentally, and he had read of small articles having been kept for a number of years, and put into drawers without being disinfected. In scarlet fever there was something that had not been grasped. The bacillus had not yet been found, although it was a most common disease. That spoke volumes for their ignorance about the disease. He quite concurred in the remarks made by Dr. Scurfield and others with regard to each officer collecting special information, and as far as possible striving to strike out a new line for himself.

Dr. Waddy (Sheffield), in reply, admitted that his paper applied only to one town and one particular hospital. With regard to the rateable value of the houses from which the patients came, it was £8 18s. for those going to hospital and £10 15s. for those staying at home, and that was in proportion to the accommodation. It was his conviction that if authorities were to deal successfully with scarlet fever cases in hospital they must *isolate* them. By taking scarlet fever cases and herding them together they increased their infectivity. If they wanted to deal with them properly they must provide many small wards.

ON THE SPREAD OF DIPHTHERIA IN SCHOOLS.

By RALPH H. CROWLEY, M.D.
(Member).

DIPHTHERIA was a disease at one time almost unknown in Bradford, and its rapid increase year by year, not in Bradford only, but in many other large towns, makes it necessary that all possible measures should be taken to prevent it spreading.

I wish, therefore, to bring under your notice to-day some notes on an investigation into an epidemic occurring in one of our schools in Bradford during the earlier part of this year.

Before the Christmas holidays no cases were reported among the children attending St. Stephen's School. On January 11th the schools re-opened, and on January 13th a child attending the Infants' department, who had just recovered from mumps, contracted diphtheria. She was not known to have been in contact with the disease anywhere, and there had been no sore throats nor illness of any kind at home. Two other children in the same department sickened the following evening—all three of these children were in the same class room. After this the disease spread indiscriminately through the department.

In a similar manner cases arose immediately after the opening of the school, on January 11th, in the upper department, and spread irregularly through all the standards.

I do not, however, intend to discuss the question of how the disease was introduced into the school, but rather the cause of its continuing to develop.

On January 29th the school was closed for a fortnight, being re-opened on February 15th, after which there was only one case in the Infants' department (on February 24th) until March 1st, and during March the numbers again went up, eleven cases occurring, the last one being on March 22nd before the closing of the school for the Easter holidays on March 31st. After the re-opening on April 11th, five more cases developed and school was again closed on May 11th.

Similarly in the upper school fewer cases developed after the first closing, but later on the numbers again increased necessitating closing once more. In all about forty children have had diphtheria in the upper school and twenty in the infants' school.

The spread of the disease must be considered to be due either to some outside source, *e.g.*, an infected area in proximity to the school, to some defect in the school itself, to infection from child to child either directly or indirectly in school, or to one or more of these combined. The first can play but a very small part; the disease covered a considerable area, and, moreover, there were hardly any cases at all at the neighbouring Board school of Ryan Street. The school itself, from a sanitary point of view, has been carefully overhauled, and it does not seem possible to attribute the epidemic to the premises.

It therefore seems certain that the disease spreads chiefly during school hours both directly and indirectly from child to child. On the morning of May 6th and afternoon of May 7th swabs were taken of all the throats of teachers and children in the Infants' department, numbering in all 93. These were sent to Dr. Eurich, the city pathologist, upon whom fell the tedious work of examination, and as regards the methods of examination he has sent me the following note:—

"Löffler's culture medium was inoculated and the growths thus obtained were examined. (1) Stained with Löffler's alkaline methylene blue. (2) Stained by Neisser's method for bringing out the polar bodies, the colonies thus examined being not more than 20 hours old and not less than 12. As it was necessary to examine the throats of all the children as nearly at one time as possible, it was not practicable to test the amount of acid reaction. The virulence of the colonies could unfortunately not be determined as we have no power to conduct such experiment."

The result of the examination was as follows:—

Negative: 51. Diphtheria bacilli present in varying numbers: 42.

During the swabbing of the 93 throats no clinical evidence of diphtheria or indeed of sore throat was found. Inquiries were made at the houses of all the children where a positive reaction was found, with the following results:—

Left or away: 7 No illness of any sort in the house lately; no sore throat or ear discharge: 29.

All four of the household sore throats last few weeks: 1.

Had had diphtheria and had returned to school a few weeks previously: 1. Several cases of scarlet fever in the house since Christmas: 3.

Mother had sore throat two weeks ago: 1.

A control examination was made at Frizinghall school where there had been no diphtheria among the children to the knowledge of the head master for at any rate over a year. Thirty throats were examined (some from each standard) and in every instance a negative result was obtained.

I may here also allude to a small outbreak occurring in the children's ward of the Union Hospital as it bears directly on the question of prevention.

Four infants within a day or two of each other started with otorrhœa and rise of temperature, having been previously quite well. The circumstance being unusual, swabs were sent to Dr. Eurich, who reported that diphtheria bacilli were present in large numbers. As a result the children were at once isolated, but a day or two after a lad in the same ward developed ordinary faucial diphtheria. Swabs were taken as soon as possible of the throats of all the children in the ward, and out of fifteen sent to Dr. Eurich he reported diphtheria bacilli to be present in eleven. As a result all the affected throats were swabbed with 2 per cent. formalin for five consecutive days, and after an interval of other five days swabs were again taken and a negative result this time obtained in each case. There was no further development of the disease in the hospital. At the same time the throats of twelve children from the Guardian Central Home were examined, a negative result being obtained in each case.

Without further comment I would submit the following statements :--

1. Diphtheria is seriously on the increase in many of our towns, and it devolves upon us to take every opportunity of preventing it spreading.

2. Bacilli indistinguishable from diphtheria bacilli are said to occur in the throats of individuals themselves healthy and who are not known to have been in contact with the disease. Such an occurrence must, however, be rare, since in the examination of 42 such individuals no suspicious bacilli were found.

3. The presence of diphtheria bacilli in the throats of 42 out of the 93 scholars and teachers points to this as being, if not the most important, at any rate an exceedingly important factor in the continuation of the epidemic.

4. From the above facts indirect means of infection at once suggest themselves, *e.g.*, the use of slates and slate pencils, etc., in common.

5. The disappearance of bacilli from such throats is readily effected, but to take such steps when the epidemic is advanced is hardly practicable at present at any rate.

6. Whatever is done, there will always be two classes of cases causing danger: the first being represented by those who pass through the

attack without receiving medical attention; the second consisting of those in whom diphtheria is of an aberrant type, having assumed characters generally associated with other and less serious throat affections.

7. Though generally not possible to submit all inflamed throats to a bacteriological examination, still at times, especially of an epidemic, it appears highly advantageous to do so.

8. If every child suffering from diphtheria and attended by a doctor were refused permission to return to school until the throat were free from diphtheria bacilli, and if every other scholar in the same house were similarly treated, the chances of an outbreak of diphtheria would be largely diminished.

Dr. Smith (York) said the conclusion made was certainly a perfectly logical and sound one in dealing with diphtheria, but the only thing was the great difficulty in carrying it out, because so many localities were so remote from a laboratory equal to dealing with such a measure. In the meantime, it seemed to him that the only thing to do was to exclude children from school attendance for a considerable period after diphtheria. As regards the continuous prevalence of diphtheria in towns through school attendance, in the investigations made on the subject he thought the same course should be taken as with scarlet fever. They should try to follow out this line—how far did "return" cases occur in the same class at school? He thought that was an important and valuable line of enquiry. With regard to scarlet fever, he could say that it seemed to him a very important line. He had not had much experience of diphtheria, but he knew of an epidemic which was almost entirely spread through school attendance and that very largely in the infant department.

Dr. Scurfield (Sheffield) said that the use of common drinking vessels in school might be a cause of the spread of diphtheria.

Prof. Kenwood (London) said he thought that diphtheria was likely to spread in schools from the common use of drinking cups, which were far too few as a rule. There were frequently about two drinking cups for 100 children, and he thought that there was a risk of infection with one scholar drinking after another. There was also the use in common of slates and slate pencils. He was glad to find that in many schools slate pencils and slates were things of the past, and the scholars were given pencils and paper.

Dr. Crowley (Bradford), in reply, said that they all seemed agreed upon what ought to be done, but for the most part steps were not taken to carry into effect what was necessary should be done. In his town, for the most part, they did not use drinking vessels, and the children had to use the tap and take the water with their hands.

NUISANCES CONNECTED WITH PIG-KEEPING.

By GERARD C. TAYLOR, M.D., D.P.H..

Medical Officer of Health, Finchley.

(MEMBER.)

ABSTRACT.

THE principal nuisances that arise in connection with pig-keeping may be traced to one or other of four sources: Firstly, proximity of the sites to dwelling-houses or public highways; secondly, unsuitability of premises; thirdly, want of proper attention; and, fourthly, storage of sour and decomposing food.

Naturally the pig is not uncleanly, and he is found to thrive better under wholesome conditions of food and housing.

The essential points in housing are that the sties should be constructed so as to permit of thorough cleansing, and that there should be no overcrowding of the animals.

No deposit of filth should be permitted in the neighbourhood of farm buildings, and the drainage should be efficiently carried out.

So long as the use of decomposing garbage as a food-stuff is tolerated, one can only aim at minimising the offensive effluvia by the use of storage receptacles made of impervious material and kept closely covered.

THE CHAIRMAN (Dr. H. E. Armstrong) then put the following motion to the Conference, which was unanimously agreed to:—"That in the opinion of this Conference no female sanitary inspector or health visitor should hereafter be appointed by a local authority unless she has previously obtained one of the recognised qualifying certificates for a sanitary inspector, and this Conference recommends the Council of The Sanitary Institute to take such action in the matter as may be found desirable."

CONGRESS AT GLASGOW.

CONFERENCE OF ENGINEERS AND SURVEYORS TO COUNTY AND OTHER SANITARY AUTHORITIES.

CARD INDEX AS APPLIED TO THE WORK OF LOCAL AUTHORITIES.

By C. H. COOPER, M.Inst.C.E.
(Member.)

ABSTRACT.

THE old proverb that "time is money" is to the industrious a truism. By far the greatest saver of time is system, which gives the management an opportunity of grasping what is taking place, and allows of attention being concentrated on certain lines which may require special thought.

In the case of transactions conducted by local authorities with constantly changing staffs, a system which gives a concise method of recording transactions is of even greater utility than for ordinary business houses where the management is of a more permanent character.

The first essential in all systems is indexing. One has only to refer to the indexes of large libraries to find how impossible it is to keep in a proper manner a growing index in book form. In the case, however, of the trays containing the card index system, new matter can be inserted at any point merely by inserting a fresh card.

In the index used for the author's correspondence, each card refers to one correspondent, and contains the number of such correspondence, which number refers to the wrapper containing the letters; these wrappers are stowed away vertically in numerical order in drawers. The index of correspondence shows a series of numbers which refer to each letter in the correspondence, and give the heads of the contents of such letter.

Note.—The Proceedings of this Conference commenced with an Address by William Weaver, M.Inst.C.E. (*see page* 323).

To further facilitate reference to this index, cards can be used with tabs, thus if tabs are used, containing, say, 10 numbers, we have the means of seeing at a glance 10 different trades or callings of the correspondents. If, however, in addition to numbers various colours are used, the number of references becomes practically unlimited.

In the case of letters that are referred to committees or officers, a card is permanently attached to each letter containing the name of those to whom the letter is referred and their instructions, or report thereon. A duplicate of this card is kept in a special tray, to be destroyed so soon as the letter is returned, the tray thus forming a record of letters that have not been returned.

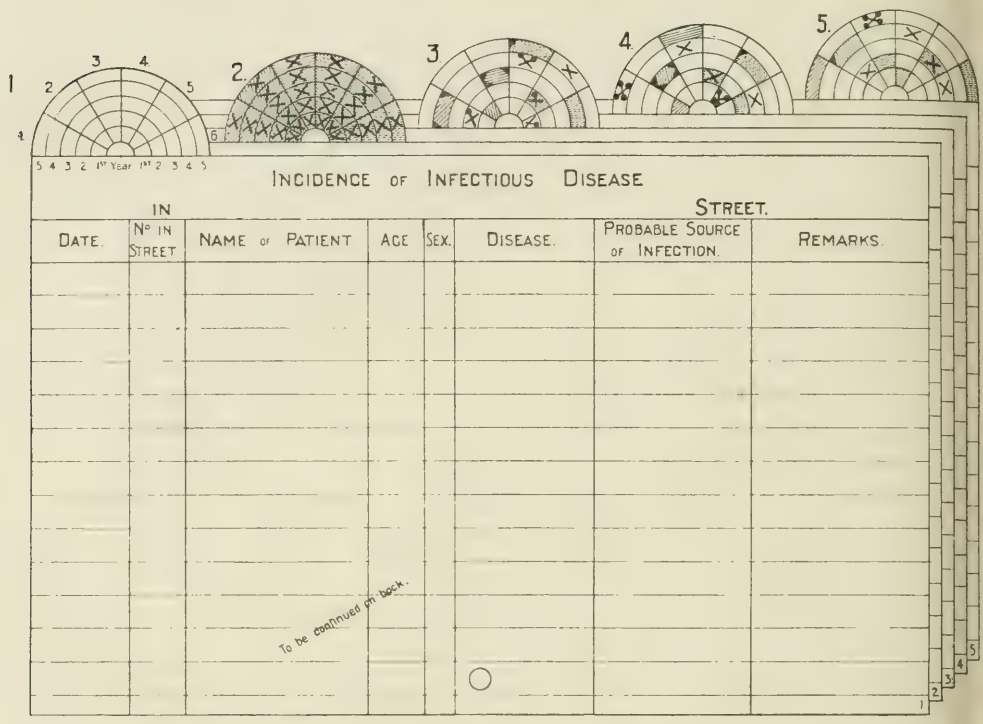
Facsimiles are given of the cards used for keeping plans, and also for recording the names of those to whom plans that have left the drawing office have been sent.

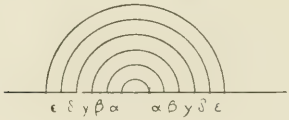
The card index ledger is one of the most convenient forms of keeping accounts, and allows of a number of clerks working on such a ledger, whereas in book form one clerk only can work at the same time.

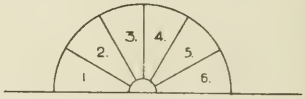
The author has found that in writing out reports, notes kept in ordinary note-books, when extending over a number of years, are practically useless, as the time involved in looking up is enormous. In the case of consulting physicians the reference to notes over many years causes very serious delay.

The author has for years kept his notes on cards which, being inserted in trays under their different headings, are available for reference at any time, independent of the period over which such notes extend. Finding the system so convenient, he has designed and patented a form of pocket-book to hold cards; the book for engineers and surveyors contains scales.

For recording the incidence of zymotic diseases he has designed a form of tab to be attached to cards. These tabs are semi-circular in shape and divided into two systems, the one a system of annular rings, which refer to consecutive years, and the other a system of radial divisions which refer to the incidence of zymotic diseases, each division recording two separate diseases, one by a particular colour and the other by a cross, thus with 6 divisions 12 diseases can be recorded, deaths being also shown. Where the annular ring corresponding to a certain year overlaps the radial division corresponding to the disease that has occurred, a colour or a cross would be inserted to indicate that such disease had occurred in such year. Each card gives a complete record of the zymotic disease occurring during a period of five years in a street, whilst the tab attached, shows at a glance what has occurred. The author has provisionally protected this form of tab.







DIVISION	DISEASE.	COLOUR OR CROSS.	DEATHS FROM DISEASE SHOWN BY COLOUR OR CROSS
No 1.	Small Pox.	Brown.	Deaths from disease shown by colour
" 2.	Measles	Blue.	
" 3.	Scarlet Fever.	Red.	1 2. 3. 4.
" 4.	Diphtheria	Yellow.	
" 5.	Whooping Cough.	Purple.	
" 6.	Typhoid	Green.	
" 1.	Diarrhœa.	X on 1.	Deaths from disease shown by cross.
" 2.	Phthisis	X " 2.	
" 3.	Typhus.	X " 3.	1 2. 3. 4.
" 4.	Erysipelas	X " 4	
" 5.	Cholera.	X " 5.	
" 6.	Bubonic Plague.	X " 6.	

CARD RECORDING CORRESPONDENCE.

Name | Ref. No.

Address | Rec'd. | Sent.

Date	Subject.		

CARD RECORDING LETTERS REFERRED AND HOW DEALT WITH

To whom sent | Letter No. | Plan No.

From whom received | Subject

Date sent | Instructions

Date Returned | Report

W. U. D. C. Engineer's and Surveyor's Department.

The President (William Weaver) said there was one point on which he would like an explanation. The way he indexed his papers in his office was to index the subject. He thought this was better than indexing the names because one could not always think of a man's name when one wanted to refer to a subject. He felt, therefore, that if the subject instead of the name was indexed, they would be able to find what they wanted much more quickly. He would like to know how Mr. Cooper subdivided his indices so that he could deal with names and subjects.

Mr. Cooper (Wimbledon), in reply, said that as regarded the index of correspondents, he had, in addition, a subject index. He thought, however, it was quite practicable to omit a subject index by using proper tabs, and hoped before long to be able to effect a saving of the time which was taken up by writing the subject index. The system in his office as regarded correspondence was this: before he came to the office his letters were opened, numbered, and indexed in the ordinary correspondence index, so that there was no trouble at all in writing up the reference cards. The subject index was written up afterwards, and it was an index he would like very much to omit. As regarded the application of the card index system there was no end to it. The Americans had got it for everything! they had cards in the courts for prisoners and for School Boards, and indeed for every single thing one could think of, and he was glad to say that in this country it was being largely adopted. He trusted that his paper would be of use to those who were thinking of taking the card index up.

MOTOR VEHICLES IN RELATION TO MUNICIPAL SERVICE.

By E. SHRAPNELL SMITH,

Sec. and Treas. Automobile Mutual Protection Association; Hon. Treas. Motor Van and Wagon Users Association; Member of Council, Liverpool Self-Propelled Traffic Association.

(Member).

IT was my privilege to address this Conference six years ago, at Birmingham, on the subject of "Some sanitary and allied advantages attending the introduction and use of Motor Vehicles." The Conference of 1898, doubtlessly weighing the inherent advantages of mechanical over animal power rather than any degree of excellence in the motor vehicles then obtainable, unanimously resolved—"That this conference of municipal engineers, assembled in connection with the Congress of The Sanitary Institute, this 28th day of September, 1898, is of opinion that the introduction and use of efficient motor vehicles should be encouraged by county, municipal, urban and other authorities, in view of the fact that the extended use of such vehicles would contribute to the general improvement of the sanitary condition of our streets and towns; and this meeting recommends that the Council of The Sanitary Institute make known this opinion as widely as possible." The resolution was moved by the author, seconded by Mr. John Price, City Engineer of Birmingham and supported by Mr. E. George Mawbey, Borough Engineer of Leicester. Since that occasion, enough has been done to improve the claims of all classes of motor vehicles to attention at the hands of public authorities, and to justify a further paper on the subject before members of The Sanitary Institute and delegates to the Congress.

Evidence of the rapid growth of automobilism is to be found in the number of registrations under the provisions of the 1903 Act. There are 212 registering authorities for the United Kingdom, to whom, on June 18th, I sent a circular letter and form. The complete returns are given in

Appendix I. It is interesting to observe that official records show the most sanguine calculations to be largely below the actual numbers—viz., 18,340 cars, and 21,521 cycles. These figures do not include cars used by manufacturers or dealers who use general identification marks which cover more than one car each. The total number of licenses to drive is 53,169. All these figures are for Midsummer Day, 1904.

The dust problem is, admittedly, one for every user of the highway, but it should be the pre-eminent concern of the municipal or county surveyor. The Automobile Club have conducted some experiments which tend to demonstrate how dust-raising varies with the design and clearances of the motor car, but we have to face the fact that thousands of miles of roads yield enough dust to render the passage of ordinary cars an inconvenience to all in dry weather. The country to-day looks to the Highway Authorities for salvation in this matter, and above all to their executive officers. This aspect of highway maintenance affects the county and urban surveyor more than the municipal engineer, but I do not err in stating that no recent instances of their activity have given greater satisfaction to the general public than those where something effectual has been accomplished in the direction of fixing the dust. Prevention is better than cure, hence the growing conviction that the construction of dustless roads must form an important branch of work for the municipal, urban, or county engineer and surveyor. I submit the dust question to this Conference as one of the most pressing importance which arises out of automobile progress. The evidence that immediate steps of some kind should be taken is so clear that a resolution will be moved.

Motors for use in municipal work, as distinct from the general use of motors by members of the public, will require consideration by more than one committee. Not a few authorities have seen a return for the outlay on the purchase of a light car for their surveyor or engineer. The motor provides a ready means of inspecting outside work, particularly in urban and county areas, and such freedom of locomotion saves both time and money by enabling the officer to supervise in person without curtailment of his indoor hours or administrative work. A number of public bodies are now alive to the wisdom of facilitating the work of their engineers by the provision of a motor. In several cases the bicycle has given way to the motor bicycle, and that in turn to the motor car. A good two-cylinder car, to seat four, can be bought for under £300, and the running cost, with a youth at £1 a week, should not exceed £150 a year, for an average distance of 180 miles a week. The advantage of a four-seated car is that members of committees can make inspections, as is

so often necessary, with the minimum loss of time, and the tonneau can be removed for other purposes if desired.

I shall pass over the application of motor tower wagons in tackling overhead electric equipment, of which two examples occur in Appendix III., likewise the use of motors in fire brigade work, and, before taking the main subject, shall refer to motor omnibus services. The cost per car-mile, inclusive of depot expenses, repairs, depreciation, driver, conductor, stores, sundries, insurances, and supervision, will vary from 8d. to 9d. for a 16-passenger omnibus, and will be under 1s. for a double decker. The increase of width to 7′ 6″, and the higher speed of 12 miles an hour, which are permissible under the new regulations, render the prospects of the motor omnibus particularly attractive, both for complete services and for feeder purposes. Where the traffic stops are frequent, as in London, a hydraulic variable speed gear, with an infinity of ratios between the extremes instead of the usual three or four steps, is of value with the internal combustion engine which is in greater vogue than steam for this work.

Passing now to the heavier machines suitable for street watering, haulage of material, and for refuse removal, we find that the Liverpool Self-Propelled Traffic Association held further series of trials in 1899 and 1901, in regard to which comprehensive reports* were issued by the Judges. These trials were followed by what may be called a commercial experiment in road transport, to wit, The Road Carrying Company, Limited, for which undertaking myself and friends subscribed, privately, the sum of £20,000 in February, 1902. The operations in Lancashire, of which I was appointed General Manager, were with 14 wagons over a period of twelve months, and they furnish a concrete instance of user under the strict letter of the 1896 Act. Each machine steamed to the weighbridge and gave an actual tare of less than three tons including the boiler, fire-bars and ash-pan. It must suffice to say that commercial success was not to be commanded with this plant. The machines were subject to endless mechanical troubles, and were structurally inefficient to take an average load of six tons divided between their own platforms and the single trailers allowed by law, whilst the narrow tyres damaged the roads under some conditions. They had no margins to withstand the overloading and excessive overdriving which are practically inseparable from the work of a haulage company.

Their working, or, to be accurate, one should say their failure to work

* The 1901 report, 170 pp., with 80 illustrations, may be had from Messrs. Lloyd and Walker, Chartered Accountants, 5, Castle Street, Liverpool, price 10s. 6d. post free.

up to the necessities of the case, resulted in general break-down, both of motors and staff, and the vehicles were "laid off" ten months ago.

The company is maintained, occupying itself more profitably in other branches of motor work, with a view to renewed activities when fresh circumstances shall have rendered the scheme more feasible.

The Liverpool trials cost £3,000, and the haulage experiment £10,000, whilst the participating constructors probably spent £80,000 over the various designs, patterns, and vehicles from which no repeat building was done. All these efforts were merely means to an end, episodes in the struggle to move Parliament to grant more latitude to self-propelled traffic, yet it must not be overlooked that all this experience is available to-day for the benefit of those who decide to become users. Much else has been done in other directions, notwithstanding the serious disadvantages involved, under the partial emancipation of the 1896 Act, to advance heavy traffic possibilities in the United Kingdom, but the majority of vehicles built since January 1st, 1900, have been above the tare of three tons unladen. Such vehicles have really been on the streets, as light locomotives, entirely on sufferance, though no action has been pressed on the score of weight on account of the lack of clear definition in the Act. Separate returns furnished by 195 of the 212 registering authorities show a total of 843 motor cars "above two tons unladen," all of which may be regarded as goods vehicles, and at least 90 per cent. as steam-propelled. There are, after making a careful estimate for the remaining 17 authorities, whose books are less clearly kept, about 950 heavy motor vehicles at work in the United Kingdom. This is a solid argument to advance in support of the purchase of motors for heavy transport, as soon as the new regulations appear, because it means that a buyer now places his feet on the heads of so many pioneers who have pulled out the chestnuts.

I inquired of the Borough Engineers of 216 principal authorities by circular letter and form dated June 15th, with the results shown in appendix IV.

Mr. C. H. Cooper (Wimbledon) said it appeared to him that they ought to be very careful about any resolution they proposed. They all knew, no matter what subject they were dealing with of a scientific nature, how very careful they ought to be in stating anything definite, and certainly he did not think such a body as they were ought to pass any resolution whatsoever on a matter of this sort. He had a copy of the proposed regulations of the Committee which had recently sat on this subject, and he must say he thought it a pity that Borough Surveyors were not brought more into touch with the matter than they had been. [*Continued on page* 824.]

Appendix I.—*Abstract of Uses.*

How Employed.	Midsummer, 1904. Cars.	Midsummer, 1904. Cycles	Estimated at Date. Cars.	Estimated at Date. Cycles.
Private purposes	14,233	16,991	15,616	18,116
Business purposes	2,164	3,158	2,380	3,370
Private and Business	598	1,372	660	1,430
Heavy goods haulage	902	—	950	—
Public passenger service	443	—	470	—
Totals	**18,340**	**21,521**	**20,076**	**22,916**

Summary.

	Cars.	Cycles.	Totals.
England.			
County Councils (without Essex).	11,777	12,750	34,662
County Boroughs	4,050	5,541	11,325
Totals	15,827	18,291	45,987
Wales.			
County Councils	383	551	1,082
County Boroughs	93	203	378
Totals	476	754	1,460
Scotland.			
County Councils	843	833	2,301
Registration & Licensing Burghs	530	419	1,335
Totals	1,373	1,252	3,636
Ireland.			
County Councils	456	827	1,380
County Boroughs	208	397	706
Totals	664	1,224	2,086
Grand Totals—Midsummer, 1904			
Without Essex	**18,340**	**21,521**	**53,169**
Computed to Date—Estimated.			
United Kingdom	**20,076**	**22,916**	**58,000**

Appendix II.—*Return of Eastbourne Motor Omnibuses, April–Dec., 1903.*

Delivery Dates.—One in April, one in June, one end August, one in September = 4 Milnes-Daimler.

Mileage.—About 90 per day per 'bus run. Total to December 31st, 1903, 36,800. Roads chiefly macadam.

Receipts.—£2,070 from 294,922 passengers carried; sundry, £204.

Total Cost.—£2,207, including management and wages, running and general repairs, repairs to machinery, repairs to vehicles and tools, tyres (£626), petrol, &c., compensation, printing, bell punches, insurance, licenses, uniforms, sundries, and sinking fund.

Petrol.—11½d. per gallon has been the average price. This is now reduced by 2d. per gallon.

Tyres.—Average over period = 4·09d. per car mile. Are now maintained by contract at 2d. per car mile.

Cost per Car Mile.—14·39d. over the period. The results for the half-year ending June 30th, 1904, are not yet available.

Two Clarkson steam omnibuses and two more Milnes-Daimler omnibuses have been added since March.

APPENDIX III—*Return of Motor Wagon*

Authority.	Number Employed.	Maker.	Motive power.	Price.	Class of Work.	Economies per motor per annum.	Unfavourable comparison with horses in any work.
				£			
Metropolitan Borough Councils—							
Chelsea	5	1 Thornycr'ft 4 L. S. M. Co.	Steam	1 at 550 2 at 475 2 at 568	Cartage and watering	Yes	Yes
Hampstead	2	Thornycroft	,,	750	Cartage and watering and refuse removal	Yes	Possibly in dusting
Kensington	1	,,	—	—	—	—	—
Westminster	3	,,	Steam	750	Dusting and watering	£100	—
County Boroughs—							
Blackburn	2	Lancs. Steam Motor Co.	,,	550	Cartage	£186	Dur'g frost or snow
Bootle	2	Thornycroft	,,	1 at 835 2 at 672	1. Brushing, 2. Refuse collecting and cartage	Not sufficiently known	
Bournemouth	3	Do.	,,	750	Watering & cartage	Slight	—
Burnley	1	Coulthard	,,	600	Cartage	£80	—
Cardiff	2	Manns	,,	500	Watering & cartage	Yes	No
Folkestone	1	Savage Bros.	,,	575	Watering	33 %*	No
Gateshead	1	Manns	,,	480	Cartage	£208	—
Leeds (tramways) ...	1	Milnes-Daimler	Petrol 16 h.p.	745	Emergency & breakdown calls	—	No
Liverpool	6	Lancs. Steam Motor Co.	Steam	525	Refuse hauling	Slightly less than horses	On very short trips
Newcastle	1	Straker	,,	600	Cartage	Not sufficient exp	
Norwich	1	Yorkshire	,,	550	Cartage and watering	Yes	On slow loading & short runs
St. Helens (tramways)	1	Coulthard	,,	451	Repairs and maintenance construction tramway	Yes	No
Reading	1	Fodens	,,	565	General haulage: granite, gravel, road material	Yes	Yes
Other Authorities—							
London	2	Thornycroft	,,	—	Scavenging & watering	Yes	No
Acton	1	,,	,,	760	Dust and sweeping and watering	—	—
Glasgow	1	Milnes-Daimler	Petrol	585	Conveying grain from docks to granary	—	Yes
Smethwick	1	Thornycroft	Steam	825	Hauling and watering	—	—

SUMMARY OF MANUFA

Thornycroft ... 16 | L. S. M. Co. ... 12 | Milnes-Daimler ... 2 | Savage ... 1 |

use by Municipal Authorities.

If so, what work and extent.	Is there economy in dust and refuse collection and disposal?	Interchangeable bodies?	Cost of repairs per motor per annum.	Part most trouble.	Is speed stringently restricted?	Average load.	Maximum Load.	Average miles weekly.	Inclusive cost per annum. motor, &c.
						Tons.	Tons.		£
When tanding bout as lust-cart	No	Yes: on 3	£50 each, contract	Boilers	Not too rapid	4·75	5·0	Varies	—
—	Very slight	Yes	£80	Pistons	No	4·5	5·0	Varies	430
—	—	—	—	—	—	—	—	—	—
—	Yes	Yes	£150	Crank-shaft	Yes	2·0	3·0	200	489
—	Certainly	No	£41	Springs and boiler	Yes	4·75	5·0	140	192*
in use to	say	Yes	—	—	Yes	3·0	—	—	—
—	—	Yes	Too brief to say, but heavy	—	Yes	7 cu. yds. 700 galls.	—	Varies	—
—	—	No	£45	—	—	4·75	5·0	84	286
—	Yes	Yes	None up to now	None	In town	10·0 with 3 trailers	—	—	—
—	—	Yes	£25	—	—	—	—	—	—
—	Under consideration	No	£8 for nine months	Springs	No	4·5	5·0	80	242
—	—	No	Estimated £20	No fault	No	3·9	—	30 to 40	295
—	Slight	No	—	Axles, wheels pumps, springs	Yes	4·0	4·0	200	—
rience to	reply	No	—	Adjustment radius rods	No	4·0	5·0	250	—
—	Not tried	Yes	First eight months heavy, since slight	Wheels	No	3·5	4·5	No return	No return
—	—	No	£51	Boiler	No	5·6 gr.	—	60	177
Steep gradients uneven and soft surfaces	Not used on this work	No	—	Hind wheels	—	4·5	6·0	100	—
—	—	—	—	—	—	—	—	—	—
—	—	Yes	£115	Crank-shaft	Yes	3·5	4·0	—	624
Refuse collection	No	No	£125	Gear-box	No	2·25	3·25	90	—
—	—	Yes	—	—	—	3·75	4·0	—	—

TURERS REPRESENTED.

Coulthard ... 2 | Manns ... 3 | Straker ... 1 | Yorkshire ... 1 | Fodens...1 | Total ... 39

* Without depreciation.

Mr. J. Phillips (Wigan) said he would like the President to tell them how far they would be within their rights in passing the resolution which had been distributed. Personally he approved of it very heartily. They all wanted to see motors made more use of, and especially for town work. The town which he belonged to had heavy gradients, and it was cruelty to work the horses with the heavy loads they did, and he had long wished that motor traction could be more used for that work.

Mr. H. H. Humphries (Erdington) said he supported Mr. Cooper's objection to the passing of the resolution. They might pass an abstract resolution to the effect that the dust required dealing with, but he felt they would disagree very much as to the best methods of reducing the nuisance. The resolution before them seemed to specify what should be done. As a matter of fact, the best material they could get to mix with tar to make the most satisfactory tar-paved road, was not the best material for wear. As they had so many different opinions on this point it would be objectionable to pass a resolution specifying what should be done. He saw no harm, however, in an abstract resolution.

The President (Mr. W. Weaver) said he had been considering the point which Mr. Cooper had raised, and he certainly felt that, as municipal engineers, they should be very careful in advocating any particular method or material; but a general resolution such as he had now prepared, and which he was willing to move, would not be objectionable, and might lead to some good. He moved: "That this Conference of Engineers and Surveyors to county and other sanitary authorities is of opinion that the advent and increase of motor vehicles on public highways renders it imperative, in the interests of public health, that municipal, urban, and county authorities should adopt methods for the prevention of dust during dry weather on macadamized roads, and this meeting recommends the Council of The Sanitary Institute to make known this view as widely as possible." As to how it was to be done, they must leave that to the authorities. When he was giving evidence before the Special Committee, the result of which was the draft regulations, he touched upon this question. He referred to the fact that this country some few hundred years ago had no roads at all, and the entire merchandise and so on was carried about the country by pack-horses. Then wheeled vehicles came into use, and the people responsible for the roads at that time had to adapt the roads for the new methods of locomotion. Now they were getting on, and the horses were gradually disappearing and motor traction was taking their place. The roads would have to be altered and suited to the new methods of traction, and there was not the slightest doubt that the ingenuity of the engineers of the coming generation would be fully equal to making the alteration to meet the new needs of the community, the same as in the past they adapted the roads for the change from pack-horse to wheeled locomotion. He felt that they would be quite able to adapt the roads for motor carriages. At the same time they must

be careful not to officially advocate anyone's methods or material in bringing about any changes, and the resolution he had read would only have the effect of impressing on road authorities the necessity for taking into serious consideration the importance of doing away with the dust nuisance, which was now disastrous to the comfort of suburban residents. He felt that the points in the paper which more affected the municipal engineer, was first this dust question, and then the question as to how these heavy motor vehicles affected the several districts wherein they were engaged. The greatest nuisance which those of them who were engaged in metropolitan districts experienced was the noise, and the subject of noise had not been touched upon in the paper. He thought there should be stringent regulations against the employment of noisy, heavy traction engines going about in the quiet hours of the night, and preventing people getting any sleep. As to the conversion of the roads to motor traffic, it might interest some of his fellow surveyors if he referred to experiments he was making himself, in paving roads with refuse clinkers from their destructors. He got his Board the previous evening to pass his scheme of £6,000 for putting up a clinker house with the necessary machinery for making the blocks for paving the streets. He had made such blocks and had had them down for two years on an omnibus pull up, and he found that they had worn very little during that period. He proposed gradually converting all his macadamized roads into sanitarily paved roads by clinker blocks from the refuse, and he estimated a saving of £5,000 a year in road maintenance by so doing.

MR. STRANGE (Eastbourne) said he had no more figures before him than were supplied by Mr. Smith. All he could say was that the motor services in Eastbourne were highly appreciated by the inhabitants. The greatest difficulty was from the fact that they started the service before they were ready. There was a little local jealousy with the omnibus company, and the horse-omnibuses were all taken off the roads. In order to cope with the extraordinary traffic which took place in consequence of this, their service was put to such a strain that they were unable to get sufficient omnibuses to maintain the service as effectively as they should have. So far, however, as their experience went, they had not come upon the rates for a single penny, in relation to the motor service. The balance was a small one, but upon the right side. The great difficulty was the constant break down of the vehicles, but that could be obviated by having a sufficient number of omnibuses in hand so that in cases of emergency there was always one to take the place of another.

MR. BREACH (Eastbourne) said the greatest difficulty they had to deal with at the present time was that of the dust. Everyone knew that in dry weather there was an enormous amount of dust to be dealt with, and the great difficulty of the municipalities was to deal with it, and to do so without sufficient horses to horse the water carts. In wet weather they did not require the horses. In Eastbourne they found the difficulty, and to meet the difficulty and get the

work done, they made a practice of hiring. But here again a difficulty arose, as to arranging with contractors to supply horses in dry weather, for which they had no use when it rained, and consequently, when they had required so many horses for use in the water carts in the morning the contractors were unable to supply that number, and so many roads had to go unwatered. With reference to the material for the laying of dust, he knew that on an estate at Eastbourne they used a material known as Westrumite, but there was one objection to that, in the smell. In all health resorts, the more they did away with smells the better it was, and there was a certain unpleasant odour attached to this material, but so far as the actual laying of the dust was concerned it was a great improvement. He had seen a road watered with it in the morning, which had gone the rest of a hot day without anything more being needed. There was, however, the unpleasant odour, and that also was one of the difficulties they had to meet with regard to motor omnibuses. As to noise they were not much troubled with traction engines in the streets at night, but they had by-laws prohibiting traction engines going through certain streets at certain times of the day. They had, however, recently had complaints made as to the noise made by the motor omnibuses. They could never get anything to perfection, and there were always people ready to grumble at anything municipal authorities did. Taking one thing with another, he believed that the service of motor omnibuses being run at Eastbourne was gradually doing away with the idea of introducing tramways. They had differences of opinion as to whether there should be trams or motor omnibuses, and, so far as the inhabitants were concerned, they were coming round to the opinion that, at least at health resorts, the best mode of conveyance was not tramways, but motor vehicles.

The President, in putting the resolution to the meeting, pointed out that it would be only an expression of opinion, and would have to go before the council to be confirmed.

Mr. E. G. Mawbey (Leicester), in seconding the resolution moved by the President, said it would be an informal vote, because it was not upon the programme. He felt they were all indebted to Mr. Shrapnell Smith for the enormous amount of trouble he must have taken in preparing the paper. The two main points which Mr. Smith raised were, first, that he wished to get rid of electric tramways. Well, Eastbourne might be all right, but there was a difference when they came to a large town like Leicester. In Leicester they had carried out an electric traction scheme, and it was strongly brought before the committee that they ought to consider whether motor omnibuses might not be the best thing. They did very carefully consider the question, but they came to the conclusion that as they would have to carry something like three or four times their population every week, which would eventually mean something like a million passengers, it would take a very large crowd of omnibuses to do this. He could quite realise that in a nice seaside town they might succeed with omnibuses, but he

was afraid the time had not come when they could adopt them in large towns, in preference to electric tramways. Mr. Breach had pointed out the difficulties of noise, dust, and smell which had to be got over. A reference had been made to motor cars for municipal engineers. Mr. Smith was very enthusiastic there again, and so was he, because he was president of the Leicestershire Automobile Club, and had driven a car at his own expense for the last three years. He was rather afraid, however, that Mr. Smith's figures as to maintenance were rather too low, in respect of a four-seated car, and they must be taken with a little caution. Mr. Smith was just as enthusiastic when he told them what it would cost to run motor wagons. They who had to advise these authorities must be very cautious not to commit themselves to figures, and then find their figures largely exceeded. He did not say that Mr. Smith was very wrong, but he thought he was on the doubtful side. As to the cost of motor wagons, they had gone into it at Leicester, and had come to the conclusion that it would not do to use motor wagons for dust collection because the distances to the refuse destructor were so short. What they did find on going into the matter was, that where they had a great deal of material to move—material for works, or where they were clearing destructors of clinkers, it would pay. They had about 80,000 tons of stuff to get up a hill, about 100 feet high, and two miles from the station, and there could be no doubt as to the advantage of having motor vehicles for that purpose. Again, where the distances were very long, where they had to cart clinkers and bring back gravel, he was certain that motor vehicles would pay thoroughly well. Personally, he was certainly in favour of them where there was a great deal of heavy work to do. With regard to the dust question there was no doubt that motor cars were a perfect nuisance under certain conditions. It was no good trying to do away with motor cars, because they had come to stop. He hoped that municipalities would, in the near future, provide surveyors with motor cars, because, especially where they had big districts to cover, it would pay to do so. In a paper he wrote for the *Motor Car Journal*, he pointed out the advantages they would be to surveyors, in the saving of time.

The resolution was then put to the meeting, and carried.

The President said that his experience was exactly the same as Mr. Mawbey's with regard to the use of motor wagons for municipal purposes. If they had a lot of cartage to do and a heap of stuff to be moved away from one spot to another, motor cartage was much cheaper than horse cartage. With regard to the employment of motor wagons for the collection of house refuse, and the divergencies of opinion as to whether it was economical or not, it all depended upon how long they allowed the dust to accumulate in houses. If they had to pull up at forty houses and get a few baskets from each, motor wagons were out of the question; if on the other hand they allowed the dust to accumulate and were able to fill a wagon from a dozen houses in a street,

then motors would pay. But that system of allowing the dust to accumulate would not do in metropolitan districts. He did not know what they did in the country districts, but if a man had to go down a flight of steps and into the back garden to get half a basketful of stuff, and go to forty or fifty houses to fill a van, it would be a costly method of collection to have motor wagons. His advice to his brother surveyors was not to embark on motor vans unless they had a fitter's shop of their own where repairs could be done. If they had to send the motor to the makers to be put right, and they kept them for best part of a week, it meant a lot of trouble.

Mr. E. Shrapnell Smith (London), in reply to the various points raised in the discussion, said it was true that where the municipality had a fitter's shop it was an advantage, but if they looked at the returns they would see that some of the makers entered into maintenance contracts, and if that was done they of course had a guarantee of what their repairing bill was going to be. They would not be going into an uncertainty if they did this, for the makers took the risk. In the case of Folkestone, where the wagons were Savage Brothers', they entered into a maintenance contract for £25. He had entered into discussion with reference to this, and found it did not include the fitting of the parts, so that that was not a correct figure. In Chelsea they were maintained at £50 per annum by contract, and a fitter had to reside on Chelsea wharf. He understood that several manufacturers were prepared to enter into agreements with Corporations, taking all risks, for £75 a year. He thought if they pressed the point with makers they would get a satisfactory maintenance contract for £75 a year, and if they did not get a resident fitter for one machine, at least they would get in men who would be at their call at very short notice. It was perfectly true that he had not given the percentages of idle time, but he did not know where it could have been furnished, because motors were only newly introduced, and he did not think that all the authorities kept their records. He could not get fuller replies than he was furnished with. As to the question of omnibuses and tramways, he did not intend to convey the view that motor omnibuses were of universal application. He agreed that in large towns where there was a great traffic, electric traction from a central generating station would beat motor omnibuses with a self-contained generator; but he thought there were many cases of towns with a population up to 60,000, 70,000, or 100,000, especially if they were watering places like Eastbourne, where much was to be said in favour of motor omnibuses. If they could give an efficient service of omnibuses at half the capital cost it would satisfy the ratepayers, but figures showed that the cost per car mile of running motor omnibuses was more than for electric tramways. When he spoke of the cost of light cars he did not mean a car such as Mr. Mawbey had. He was much interested in reading Mr. Mawbey's article in the *Motor Car Journal*, and he said that his tyres cost him 2d. to 2½d. a mile. His tyres cost him only 1¼d. a mile, and if they reduced that to under 1d. for the

car he had in mind, then he thought Mr. Mawbey would agree that his estimate was not so far wrong. The unfortunate thing about estimates was that one had a great tendency to state what could be done and what had been done where the management had been very careful and everything had been fortunate; but on the other hand it seemed unfair to take the worst conditions. Still, he agreed that the danger of estimating was that one stated what could be done and in a large percentage of cases, owing to unforeseen circumstances, and bad drivers and bad luck, the estimates were largely exceeded. That might enter into the heavy traffic figures as well as the light traffic figures. They would see the diversity in the table he had referred to. One authority maintained at £40 a year and one at £150, and yet they were all motor vehicles and "much of a muchness" about them. Why there was such a divergence wanted a lengthy investigation to explain. In regard to the heavy lorries used for watering and other purposes, he was of opinion that experience had shown that for dust collecting where they had to wait about it was hopeless. If they got big loads and got a lot of men at work, and there was little delay, then there might be a little economy but not a large one. As to street watering, Mr. Bradley of Westminster estimated a saving by the use of motors of £300 a year. For watering in places like Eastbourne, where Mr. Breach had said there was a difficulty in getting horses, if they had a motor which they used partly for watering and partly to carry heavy paving materials or coal from the station to the gas or electricity works, there was a possibility of economy that way. He knew a wagon working between Preston station and the gas works, which were only half a mile away. It went right under the coal tip, took a load of coal, and went straight away to the gas works. It did 70 tons a day and the cost came out at 4d. per ton. The only other point was as to noise. He did not admit that motors were as noisy as traction engines. The Committee of the Local Government Board, before which the President and he himself gave evidence, had issued recommendations which would have the tendency to check that noise, because they would limit the weight per axle and the speed. So far there had been plenty of motor lorries on the streets with 11 or 12 tons on per axle, and the authorities had been so busy looking after light cars that they had not looked after the heavy ones. Now they would have six months to alter their cars. Personally he had no sympathy with those people who had been breaking the law, and taking advantage of those makers who had been adhering to the legal tare.

In addition, a paper was read by W. HILLMAN, entitled "Brief Notes on the Utilisation of Destructor Residuals." The following speakers took part in the discussion: The PRESIDENT (W. Weaver), E. G. MAWBEY (Leicester), DR. W. G. WILLOUGHBY (Eastbourne), MR. SMITH (Kettering), C. H. COOPER (Wimbledon), MR. BREACH (Eastbourne).

CONGRESS AT GLASGOW.

CONFERENCE OF VETERINARY INSPECTORS.

THE PRESENT POSITION OF TUBERCULOSIS AS AN INFECTIVE DISEASE DANGEROUS TO MAN.

By J. McLAUCHLAN YOUNG, F.R.C.V.S., F.R.S.E.
Lecturer in Veterinary Hygiene, Aberdeen University.

THE report recently issued by the Royal Commission on Tuberculosis has officially fixed to a certain point the position of tuberculosis as an infective disease dangerous to man, and although no details are meantime given, the results are similar to those obtained by a number of other investigators. The somewhat presumptuous nature of the title of this paper, and the fact that it was necessary to fix the position, at once suggests that our knowledge of this disease is not like that of other abnormal conditions, and that there is something controversial in its history or manifestation. I venture to think there is universal agreement as to its clinical evidence and its pathology; but in the etiology and pathogenicity opposing opinions have been expressed, and we are now at the stage when an endeavour is being made to remove the doubt, and finally fix a basis upon which all prophylactic measures can be built. To clearly understand why such an endeavour was necessary, we must look back a few years, and consider the forging of the chain which we hope one day will encompass the disease, and fix limitations to its power of invaliding thousands of human beings and causing the death of a still greater number. Ever since Koch discovered the bacillus steady progress has been made, and link after link added to the chain, until we believed we were in a position to recommend

NOTE.—The Proceedings of this Conference commenced with an address by PROF. JAMES MCCALL, F.R.C.V.S., (*see page* 325.)

measures which, if strictly observed, would successfully check the dissemination of the disease and save many valuable lives. Thus steadily did the work proceed, until suddenly a link some distance back in the chain was declared by a high authority to be defective. There was thus a temporary cessation of the work, and it was necessary to go back, test and strengthen that particular point. There is every reason to think that the work is nearing completion, and it is not too much to anticipate that the link in question will become the strongest in the whole chain, and the one upon which all preventive and suppressive measures must be dependent.

It was considered, and by most taken as proved, by the Commission of 1895–98, that tuberculosis existed as a specific disease in man and the lower animals, and that it was transmissible from one to the other, especially from bovines to man.

This was the opinion until Koch made his surprising and memorable statement at the British Congress in July, 1901, and it was, and is even now, impossible to over-rate the effect of the statement, coming, as it did, from one universally recognised as the highest authority on the disease. He sought to make little of the danger of transmission from bovines to man, for in concluding that part of his address referring to such transmission he said, "I should estimate the extent of infection by milk and flesh of the cattle and the butter made of their milk as hardly greater than that of hereditary transmission, and I, therefore, do not deem it advisable to take any measures against it." That statement could not be instantly accepted, but the eminence of its author forbade its being dismissed without further enquiry, and at once many investigations were undertaken to prove or disprove his contention. Many, when they considered the number of cattle affected and the opportunities by which transmission might take place from bovines to man, hoped the pronouncement might be true, and from a public health point of view such a hope was creditable; but pathologists and those who had studied the disease in its various phases, although wishing such were the case, felt that the danger was only too real, and that the death of many a child could be directly traced to the use of milk from a tubercular udder.

Koch was unable to produce lesions in cattle by inoculating them with tubercle bacilli from man, and that fact he made the basis of his argument that human tuberculosis differs from bovine. Until that argument was accepted or refuted, it was impossible to fix the position of tuberculosis of cattle as a disease dangerous to man, and many determined to make investigation knowing that when the results were collated a definite finding

would be arrived at. I had the honour to be associated with Professor Hamilton in an investigation the object of which was to ascertain if the bacillus taken from its natural habitat in man, without being subjected to any influence which might modify the process of reproduction, is capable of transmitting the disease to bovines.

Since the results of this investigation have been published several others, including the Royal Commission, have issued reports, and as the findings differ but slightly in detail and agree on the main, it can be taken that human tuberculosis is transmissible to bovines; although that is but a step, it is an important one as the natural analogical deduction is that the converse is equally true.

As tuberculosis with very few exceptions develops slowly, this stage of opinion was not reached without patient and careful inquiry. The line upon which the various investigations were conducted was the same in each, differing perhaps in detail, and as I have made an assertion it is desirable and may be of interest to show upon what proof such a contention is put forward. As our object was not to ascertain the resistance or susceptibility of various animals, but to find whether human tuberculosis could or could not be transmitted to bovines, we therefore used solely calves in our investigation, and these animals were kept under conditions as natural as possible, and absolutely free from any risk of infection.

Recognising that hereditary tuberculosis is a pathological rarity, it follows that the younger the animal the more likely is it to be free from tubercle, and for that reason we used young animals from two days to ten weeks old. We also tested the calves with tuberculin, and in this way were assured of tubercle free animals upon which to experiment. The methods of introduction were ingestion, inhalation, and inoculation, and in a very large majority of the twenty calves conclusive tubercular lesions were produced. Some were more pronounced than others, but in no way did this affect the result, as in no two cases between the introduction of the tubercle material and the death of the animal was the interval the same, and the degree of resistance could not be equal in animals of different ages and breeding. As this is true of various animals, it is equally true of different organs in one body, and there are organs predisposed to tubercle which offer less resistance to infection. In one or two of our calves, where the period allowed for the development of the disease was short, we found interesting changes in the glands. They were enlarged, but were not, as one critic said, the ordinary somewhat enlarged glands of the young animal whose diet consists chiefly of milk. The histological structure was interfered with, and this alteration of structure,

especially when confined to the glands of the gastro-intestinal tract in those cases where the tubercle material was introduced along with the food, was, at least, gravely suggestive of tubercle origin. In other cases where the calves were kept longer the disease had developed, and was macroscopically manifest; so much so in a few as to indicate acute tuberculosis, which would speedily result in death. If, then, animals proved tubercle free by testing, kept in premises free from infection, and fed on milk from sound cows, should at the end of from three to six months show, on post-mortem examination, tubercles at various stages, there could be but one conclusion, viz., that the inoculation, the ingestion, or the inhalation was the source and cause of the lesions.

Many investigators had previously carried out and were now repeating similar experiments, and corresponding results have been obtained. Thus I take it as proved that human tuberculosis can be transmitted to bovines. I admit it is only by analogical deduction that we can contend bovine tuberculosis to be communicable to human beings; but surely, when we have records of its transmission to many animals of different species, including animals not so far removed from man, also numerous cases of accidental inoculation, and finally, the suspicion if not the actual suggestion in the high infantile mortality, we must conclude and take measures to minimise the opportunities whereby the disease might be transmitted.

Leaving aside accidental inoculation, I think it will be agreed there are but two ways by which the disease is likely to be transmitted, viz., aërial and alimentary. We need not discuss the first, for however great the possibilities may be, the probabilities are very small; and, likewise, when we discuss the second we must not exaggerate. I venture to think there are but few who do not admit that the flesh of tubercular animals is capable of conveying the disease, but when we know the lesions are most commonly found in parts easily removed, or in parts not used for food, and in most cases, except in cows, confined to those parts, and also that meat is cooked before being ingested, it becomes apparent the danger can be over-rated. As strong language tends to weaken argument, so exaggerating the danger tends to excite derision and callousness. A scientific and uniform system of meat inspection would minimise if not remove this source of danger; and I would commend to large municipalities the Freibank system of Germany. There they recognise certain carcases to be unwholesome only when uncooked, and the meat, after being cut up into pieces of about 4 lbs., is cooked under the supervision of the authorities and sold to the poor of the town at reduced prices. I recognise the danger in meat, but consider it small

when compared with that in milk; in fact, I believe milk to be the most potent factor in the transmission of the disease from cattle to man In direct contrast to meat, milk is seldom cooked and it constitutes the major portion of the child's diet. In the intestines of children there is a special predisposition or, in other words, an absence of the antagonistic resistance seen in the intestines of adults, and if the child be given milk drawn from a tuberculous udder, the bacilli are only too easily absorbed by the lymphatics. The result is a tubercular focus which may from that moment continue to grow until it becomes sufficiently destructive to cause the death of the child, or it may remain in abeyance, latent and viable, until a predisposition has developed, because of some system change, when it becomes active and eventually helps to increase the already high mortality. It is important, therefore, to note that, although death took place in after life, the infection occurred during infancy, and this will occasion little surprise to those who know that it has been proved by Disse and Gruelin that the epithelium of the intestines of children and young animals is not always completely developed some time after birth. Indeed, upon that fact and his own observations Behring holds (1) that young children and animals cannot resist the infection with tubercle bacilli; (2) that the infection with tubercle happens almost only in the early years of life; (3) that the tubercle bacillus can be latent in the body for an unlimited time, so that the disease can appear later if on account of the conditions of life the predisposition has been developed; and (4) that infected milk must be the chief material of infection. Although there is a real danger in milk, the hysterical demand that all milk is dangerous and must be sterilised, is not to be commended, as to my mind it has been conclusively proved that it is only milk from a tubercular mamma that is capable of inducing tubercle in the consumer. The results of many inoculations made with milk in the usual way show that not a single animal used for inoculation contracted tubercle, although the cows in many cases were suffering from advanced tuberculosis; but in every case where the udder was the seat of disease the inoculated animals became tubercular. Fortunately the number of cows suffering from tubercular mammitis is not large, certainly not more than five per cent., and thus the task of dealing with this source of transmission is not too formidable, and by the appointment of veterinary inspectors, with power to stop the sale of milk from such cows, a genuine effort would be made to remove the danger.

I think it has been abundantly proved by official and private investigation that human tuberculosis is capable of transmission to bovines, and

I venture to offer the opinion that the converse is equally true, viz., that bovine tuberculosis is transmissible to man. If that then be the present position of tuberculosis, every endeavour must be made by the veterinary profession to advise and assist stock owners and public authorities to take steps to remove the opportunities by which transmission can take place, and by scientific means and hygienic conditions to aim at the reduction of the prevalence of the disease in the bovine race. Success will crown our endeavours if we associate ourselves neither with those who seek to make light of the danger nor those who would exaggerate it; but let us take a course of our own founded upon an intelligent understanding of the many publications and the results of our own honest observations. We recognise that the disease is transmissible from our patients to man, but we believe by veterinary surgeons and medical officers of health working together in harmony, and with one object in view, it is possible to restrict, if not to remove, the opportunities in which such transmission can take place.

Mr. J. S. Lloyd (Sheffield) said that he was in thorough harmony with Professor Young in believing that although tuberculosis might be transmitted from cattle to man, yet the danger could practically be eliminated by systematic inspection and co-operation between the veterinary surgeons and medical officers of health. In proof of this statement he referred them to the last report of the medical officer of health for Manchester. Cows with tuberculosis of the udder were the chief sources of danger, as far as veterinary surgeons were concerned, and systematic inspection could all but remove that danger.

Dr. Mitchell Wilson (East Riding Yorks C.C.) said they were all anxious to learn the nature of and to lessen existing perils of, tuberculosis, but surely it was reasonable to expect that they should satisfy themselves as to the reality and the amount of the danger before they proceed to take remedial steps. In the London press it had quite recently been affirmed that the enormous death-rate among infants was due to an infected milk supply. He had made an endeavour to contradict that popular statement by showing that when the infant diseases complained of were most virulent and most rampant, the vast majority of cows were living, not in their sheds, but in the open air, and that most of the milk sent to London was the milk of cows living under natural conditions. He ventured to express the opinion that milk, however pure originally it might be, became contaminated after a brief period particularly during transmission from the cow to the consumer. Professor Young had told them that morning that there were two ways in which tuberculosis was most likely to be

transmitted, *i.e.*, aërially and alimentarily, but why did he go on to say, "We need not discuss the first, for, however great the possibilities may be, the probabilities are very small." He did not think that view would be accepted by the majority. The most commonly-accepted theory was that phthisis was most infectious, and that the infection was in nearly every case conveyed by sputum, and of course that was aerial transmission. He thought that they must be prepared to recognise that fact, otherwise how could it be explained that the number of cases of phthisis was being largely reduced by action consequent upon that theory. Therefore he inclined to the view that in this respect Professor Young's statement was somewhat misleading, but he would much prefer to elicit some explanations, rather than find fault with an admirable and lucid paper, dealing with a highly technical and difficult subject.

Professor McLauchlan Young (Aberdeen), in reply, suggested that the misunderstanding arose from the fact that the last speaker was considering the case of transmission of phthisis between human beings, whereas in the paper he had been dealing with the question of the transmission of bovine tuberculosis to man. Recollecting that fact, he thought they would agree with him after all that there was not much danger from aerial transmission of the disease. But so far with regard to the question of the transmission of tuberculosis from man to man, he quite agreed with the views of Dr. Mitchell Wilson, and had to thank the conference for the courteous reception given to his paper.

THE DANGERS OF AN IMPURE MILK SUPPLY,

And some Suggested Alterations in the Legislative Provisions for the Control of the Milk Supply.

By Prof. H. A. WOODRUFF, M.R.C.V.S.

ABSTRACT.

APART from the practically universal use of milk in ordinary diet, when we consider that milk is especially (and unfortunately in an increasing degree) the diet of a large number of infants under one year old, and also of invalids, in which cases the natural protective forces of the body are weak; and that while its power for good, if pure, is great, its power for evil, if impure, is equally great; it is difficult to exaggerate the importance of a pure supply. But not only are we disposed to strive for a pure milk supply by these general considerations, but also because there is unfortunately only too much evidence to show that infected milk has been responsible for many serious outbreaks of disease in the past, among the more important being typhoid, diphtheria, scarlatina, epidemic sore throat, diarrhœa, and not least tuberculosis.*

The Cow as a source of danger.—There are certain diseases to which the cow is subject which may also affect human beings, and of these the more important must be briefly considered.

Tuberculosis.—The prevalence of tuberculosis among cattle is well known, and from their conditions of life milch cattle are the commonest victims of the disease, probably 30 per cent. being affected to a greater or lesser extent. The important question as to whether bovine tuberculosis is the same disease as tuberculosis of man, and whether the infection can be conveyed from the cow to the human subject, has received much attention of late, and it is satisfactory to those who have throughout urged the

* For details see "Bacteriology of Milk," by Swithinbank and Newman. The writer wishes to acknowledge here the very valuable assistance he has derived from this work, and to express his indebtedness.

necessity for continued precautions to guard against the danger of tuberculous meat and milk, that their views have been endorsed in the interim report of the Royal Commission. Assuming then the possibility of infection by means of milk, what is the degree of danger?

It is generally agreed that only those cows with tuberculosis of the udder are likely to give infected milk, and McFadyean on this point says, "My own experience leads me to think that about 2 per cent. of the cows in the milking herds of this country are affected with tuberculosis of the udder."* This then represents the possible risk from milk, but this risk is by no means uniform all over the country. In London during thirteen quarterly inspections from 1899 to 1903, the number of cows examined was never less than 3,900, and out of these the number with "actual and suspected tuberculous udders" was on the average only 0·2 per cent.† In Manchester in 1901 of 1,839 cows (in town byres) examined, only 1 was found to have tuberculosis of the udder (·054 per cent.) whilst out of 1,441 cows in country cowsheds, whose milk was consumed in Manchester, 15 were found with tuberculous udders (1·04 per cent). ‡ These reports speak volumes for the success of efficient inspection and supervision.

Foot and Mouth Disease.—This disease is fortunately unlikely to get a permanent foothold in this country, but there is always a danger of infection being introduced from abroad in hides, wool, straw, etc. At the same time the risk is slight.

Mastitis. An inflammatory condition of the udder is so common as to be well known to every dairyman, and it is usually put down to a chill, or a blow, or to careless milking. In a recent investigation, § Henderson found three main types, viz.; tuberculous purulent, and hæmorrhagic, with streptococci as the predominating organisms in the purulent form, and a bacillus of the B. coli group as the prevailing one in the hæmorrhagic type. The importance of a correct knowledge of this condition lies in the fact that cows with inflammation of the udder have been held responsible for both epidemic sore throat and epidemic diarrhœa in the human subject. It is now generally admitted that epidemic diarrhœa—a specific bacterial disease affecting chiefly very young children—is most frequently caused by the consumption of infected milk. Newsholme is of the opinion that "the fundamental condition

* Address to British Congress on Tuberculosis, 1901.

† From Results of Examinations by W. F. Shaw, F.R.C.V.S., supplied to Sir Shirley Murphy, M.O.H. to the London County Council.

‡ Report on Health of City of Manchester, 1901, pp. 238–248.

§ A Contribution to the Study of Mastitis in Cows, *Journal of Comparative Pathology*, Vol. XVII., Part 1.

favouring epidemic diarrhœa is an unclean soil, the particulate matter from which infests the air and is swallowed, most commonly with food, especially milk." * Several organisms have been held responsible for the disease, but chiefly: (*a*) streptococci, (*b*) the bacillus enteriditis sporogenes (Klein), and (*c*) organisms of the bacillus coli type (Delépine), two of these being among those described as prevailing in mastitis. It must be noted that the great majority of the deaths from this cause occur in children artificially fed.

How important this is, is only realised when we remember that this infantile rate has remained almost stationary at a seriously high level for many years, and, in fact, reached the highest point, since 1850, in 1899, with 163 deaths per 1,000 births.

Of sore throat epidemics there have been several for which no other cause but milk could be assigned.† Two recent outbreaks near London, the one at Woking in October, 1903,‡ the other at Finchley in January, 1904,§ were attributed by the respective medical officers of health to cows affected with mastitis, apparently of the ordinary purulent type.

There are two other diseases in which cow's milk has often been the medium of infection, and, more important to us, for which the cow has been held by many to be directly responsible; these are Diphtheria and Scarlatina.

Diphtheria.—An important question is whether the cow may be the subject of this disease and so a source of infection. In a series of experiments conducted by Klein in 1886, a culture of B. diphtheriæ injected subcutaneously in two cows produced not only the local lesion, but in five days there occurred a papular eruption on the udder and teats. In the lymph of the vesicles, and also in the milk, Klein found the diphtheria bacillus, and was able to produce a like disease in calves by inoculation.‖ In a more recent investigation by Dean and Todd of a small outbreak of Diphtheria in 1901, the cows yielding the suspected milk were found to have an eruptive disease of the udder, and cultures of virulent diphtheria bacilli were got from the lesions and the milk. Further investigations, however, appeared to show that the udder eruption was not itself due to diphtheria, but that in some unexplained way the B. diphtheriæ

* *Public Health*, 1899—1900, Vol. XII., pp. 139—213.

† "Bacteriology of Milk," by Swithinbank and Newman, p. 352–361.

‡ J. Wortley Axe, *Veterinary Record*, March 12th, 1904, p. 575–77.

§ Professor H. Kenwood, in *British Medical Journal*, March 12th, 1904, p. 603.

‖ "Bacteriology and Infective Diseases," Crockshank, 4th edition, pp. 338-339

had got into the lesions, and had been able to grow and multiply there.* This of course is far from proving that cows are the subjects of diphtheria, in fact the majority of bacteriologists agree with Crookshank that "there is not sufficient evidence to justify the conclusion that the infectivity of the milk in epidemics of milk diphtheria has been proved to be due to a morbid condition of the cow."†

Scarlatina.—As with diphtheria, so with this disease, there is the possibility of accidental contamination of the milk by contagium from a human source, either by the milker or by some person handling the milk before it reaches the consumer, and in the majority of cases of infection by means of milk this method is sufficient to account for it. But it is the firm opinion of many medical men that infection can come directly from the cow, herself the subject of the disease. In an investigation made by Power and Wynter Blyth, at the time of the historic Hendon outbreak in 1885, they were of opinion that the outbreak was traceable to a certain dairy at Hendon, and to certain cows in that dairy which were suffering from an ulcerative eruption on the udder and teats. Klein, after bacteriological investigation, expressed the opinion that the disease of the cows was the analogue of human scarlet fever. He isolated a streptococcus from the lesions in the cow, which he also found in human scarlet fever, and which he holds to be the specific cause of the disease. At the same time it is by no means accepted as proved that this streptococcus is the true cause of scarlet fever, and without proof of this it was impossible to prove that the diseased condition in the cows was the cause of the scarlet fever epidemic in human beings. Moreover, in a report to the Board of Agriculture, Crookshank affirmed that the disease among the cows was in fact cow-pox, and in this view he was supported by Wortley Axe. Again, in a series of experiments about the same time, McFadyean was unable to infect cows with scarlet fever.‡ It is hardly necessary to state that the general view of the veterinary profession is that the cow is not susceptible to scarlet fever, and cannot be looked upon as the source of the infection when milk is proved to have caused an epidemic.

Sources of Infection other than the Cow.

Infection during milking.—This arises from a dirty condition of the udder and teats, from dirt and hairs from the belly and tail of the cow, from dust arising from fodder and litter in the byre, or from want of cleanliness on the part of the milker.

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* *Journal of Hygiene*, April, 1902, p. 194.

† "Bacteriology and Infective Diseases," Crookshank, 4th edition, p. 339

‡ Ibid, pp. 270–283.

During handling and preparation.—The various utensils used for straining and containing the milk—sieves, pails, cloths, etc.—are by no means always thoroughly sterilised. In many cases, indeed, where washing alone (without the aid of heat) is relied on to cleanse the milking vessels, the water used is far from pure. The Aylesbury Dairy Co. are stated to find it necessary to reject more than half of the farms, otherwise suitable, owing to faulty water supplies.* Again, by mixing the milk of all the cows in the byre, the contamination of the milk of one is the contamination of all.

During transit.—Much of the milk consumed in large towns is produced in the country, and has to be conveyed long distances by train. The time it is kept on country stations, and in transit, often in closed or ill-ventilated vans, and almost always without refrigerators, has a marked influence on the growth and number of bacteria. Again, the churns are frequently not sealed, and both exposure and adulteration are quite possible and undoubtedly occur.

At the town dairy and during delivery.—The shops in which milk is sold may be generally classified as (*a*) those for the sale of dairy produce only, and (*b*) those in which milk is one of a great variety of articles sold. In the former the chief methods of contamination of the milk are: (1) its exposure in a large vessel on the counter, (2) the use of a special dipping-can for measuring out the milk, (3) the presence, especially in the summer, of large numbers of flies. In the latter, the chances of infection are infinitely greater and too many to be enumerated.

During delivery, in the majority of cases, the churns are not fastened and sealed, but may be opened by the milkman, so affording opportunity for adulteration and infection. In some cases, too, a dipping-can is used in delivery. Again, the common practice of buying extra milk to make out a shortage is responsible for increased chances of infection.

Typhoid Fever.—Impure water supplies to cow-sheds have already been mentioned as a source of general infection, but in the case of one disease, typhoid, the water supply is so pre-eminently the source of danger as to need special remark. Epidemics of typhoid fever have in several instances been traced definitely to infected milk, but here, at any rate, there is no difference of opinion as to the ultimate source of the contagium. In this case the cow is not suspected, but it is generally recognised that infection is from the human subject, either directly or more commonly through the medium of an infected water-supply.

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* *British Medical Journal*, April 11th, 1903, p. 877.

Another frequent source of danger is the occurrence of some contagious disease, either in the persons or among the families or intimates of milkers or others engaged in preparing the milk, and no doubt this is *the* source of infection with Diphtheria and Scarlatina. Lastly may be mentioned the danger from the use of preservatives in milk, especially when it is remembered that not uncommonly milk is dosed successively by the farmer, the contractor or middleman, and the retailer, with some more or less injurious antiseptic. No one can doubt that the effects of these agents, taken even in small doses day after day, are harmful to the consumer.

The legal provisions which apply generally in England and Wales are contained in:—

1. The Dairies, Cowsheds, and Milkshops Orders of 1885, 1886, and 1899;
2. The Contagious Diseases (Animals) Act, 1886, section 9;
3. The Infectious Diseases (Prevention) Act, 1890, section 4.

The Dairies, Cowsheds, and Milkshops Orders are made under section 34 of the Contagious Diseases (Animals) Act of 1878, and provide generally for the registration of all cowkeepers, dairymen, and purveyors of milk; for the lighting, ventilation, drainage, and water supply of cowsheds and dairies to the satisfaction of the local authority; and for the prevention of infection or contamination by servants or attendants, or by the improper use of the buildings. But besides these general provisions there are the two important sections 9 and 15. Section 9 states that "a local authority *may* make regulations for (1) the inspection of cattle in dairies, (2) prescribing the lighting, ventilation, cleansing, drainage, and water supply, (3) for securing cleanliness of milk stores and milk vessels, (4) for prescribing precautions to prevent infection or contamination."

Section 15, as amended by the Order of 1899, provides that the milk of a diseased cow (1) shall not be mixed with other milk, (2) shall not be sold or used for human food, and (3) shall not be used as food for swine or other animals unless boiled; and *in the case of (1) and (2)*, these shall apply to disease of the udder certified by a veterinary surgeon to be tubercular.

The Contagious Diseases (Animals) Act, 1886, section 9 (4), gives the officer of the local authority power of entry for enforcing the said Orders (not including the Order of 1899), and this Act also defines the "local authority" as the Rural or Urban Sanitary Authority (and so gives no power to the County Council).

The Infectious Diseases (Prevention) Act, 1890, section 4, gives the medical officer of health power to inspect any dairy, and, if accompanied

by a veterinary surgeon, the cattle, if he has evidence that the milk is causing infectious disease (not including tuberculosis), provided that he has an order from a Justice having jurisdiction in the district. The dairyman may then be required to show cause why an order should not be made requiring him not to supply milk in the district.

Of the alterations in, and the additions to the foregoing, which are necessary to adequately protect the public, the most essential is that the "may" of section 9 of the Order of 1885 be altered to "shall," *i.e.*, the Order must be made obligatory on all local authorities. This is the first step to uniformity of procedure, the absence of which is a cause of great injustice in many cases. Then the word "disease," as used throughout these Orders, must be made to include not only tuberculosis of the udder, but also all cases of tuberculosis in which clinical symptoms can be seen, such as tubercular enteritis and diarrhœa; and further, cows with tuberculous udders should be compulsorily slaughtered.

Another most important addition to the law is the making of notification of all udder diseases incumbent on cowkeepers and dairymen. It is manifestly both unsafe and unjust to allow the dairyman to decide which are dangerous affections of the udder and which are not, and especially in view of the fact that the diagnosis of tubercular mastitis calls for a good deal of pathological and clinical experience, and is a matter of difficulty even to the veterinary inspector.

With regard to the construction of byres, it is unfortunate that the Model Regulations fail to specify the minimum cubic space requirements for country cowsheds, and having in view the very insanitary condition of these, it would be well to require the same cubic space as in town byres, viz., 800 cubic feet for each cow.

It is also highly necessary that the local authority should have similar powers to those conferred by the Public Health (Scotland) Act, 1897, section 61, by which the local authority, on the certificate of the medical officer of health, or other legally qualified medical practitioner, that the outbreak or spread of infectious disease is attributable to milk supplied by any dairyman, whether wholesale or retail, may require the dairyman, whether within or without the district, to furnish a complete list of his customers in the district, and also of the farmers and dairymen or others from whom the milk was obtained.

Lastly, as was recommended in the report of the Departmental Committee on Preservatives and Colouring Matters in Food, 1901, the use of any preservatives or colouring matter whatever in milk should be prohibited.

Councillor J. Ellison (Bootle), as one who had long been connected with the milk trade, said he had been somewhat surprised at the statements contained in Prof. Woodruff's paper. The poor cow was saddled with the responsibility of being the cause of typhoid, diphtheria, scarlatina, sore throat, diarrhœa, and tuberculosis; in a word, she was held responsible for almost every disease under the sun. The cow gave pure milk, and if it got contaminated afterwards, they should not blame the cow. He had been twenty-four years in the milk trade in Liverpool, and now learned for the first time the terrible power which the cow possessed as being a disease producer. They were setting up an artificial standard for a natural production, and compelling the dairyman to have three per cent. of cream in his milk whether the cow gave so much cream or not. It was his firm conviction that if scientists gave a little of their valuable time to catching flies and stray cats or other pests of mankind in large towns, they would be doing far more for the public health than by chasing cows through the country.

Dr. J. Mitchell Wilson (East Riding Yorks. C.C.), agreed with Prof. Woodruff in his contention that many of the regulations at present optional should be made compulsory. There should be systematic inspection, and from this the man who kept his cows under proper conditions had nothing to fear. It was the careless or purposely negligent cowkeeper who would suffer, and justly so. As a medical officer in various districts, he had had considerable experience in inspecting cows and cowsheds, and he had no hesitation in saying that 600 cubic feet per cow in the country was as good as 800 cubic feet in the town, and he was not in favour of laying down a hard and fast rule for town and country alike. What comparison could there be between a cowshed in the country, open on three sides, and one hemmed in by dead walls and stables in a crowded city? The attempt to make regulations uniform in this respect was a mistake, and had the disastrous effect of causing not merely dissatisfaction among cowkeepers but unsettlement among the sanitary authorities in rural districts. The proper ventilation of a cowshed was a most important matter and deserved every attention, because it was quite possible to have the necessary air-space per cow, and yet with a very undesirable state of the atmosphere of the shed. The question of lighting was hardly less important. For a speedy and effective settlement of the whole question he considered that there must be agreement and co-operation between medical officers of health and veterinary surgeons.

Mr. R. W. Edwards (City of London) observed that he was a good deal perplexed at some of the statements made in the two addresses to which they had listened that morning. In London the authorities had been taking every precaution against infected meat and milk, in the belief that the danger from these sources could hardly be exaggerated, and it was rather extraordinary now to

hear, that after all, those dangers were but slight. Was a person to submit to the possibilities, or to take precautions lest he should be the one to suffer from the real danger, and come under the small percentage?

Mr. Hugh Begg (East Kilbride), referring to the remarks of Dr. Mitchell Wilson, said the question of air-space for town and country was at least of practical interest. In the country care had to be exercised in the selection of a good site, otherwise full air space and ventilation might merely lead to other troubles. He had in his mind the case of a certain byre built in the country with full air-space and proper ventilators, and yet those ventilators had to be cemented up, or covered with cloth, before the temperature could be kept at anything like 45 degrees. The explanation was that the byre had been built on a bad site, exposed to the coldest winds, and ultimately had to be entirely remodelled. The ventilation and the cubic space of a byre had a direct relation to each other. He would be averse to any arrangement which would permit of the air of a byre being too frequently changed by draughts, as then the cows would suffer from chills, and consequently would give a diminished quantity of milk.

Mr. J. S. Lloyd (Sheffield) was convinced that the milk supplied to towns was much better than that to be obtained in the country districts, owing to the better system of inspection in the towns, and the more rigid enforcement of the regulations. He thought the adoption of the dairy regulations should be compulsory, as also a system of reasonable and uniform inspection. In New York certain milk sellers were licensed by the medical officer of health, and held a certificate to the effect that they kept their cows in the best condition, and that they sold milk of sufficient fat. These particular retailers asked and received a higher price for their milk than that charged by the other retailers, and that plan seemed to work very well. It might be adopted in this country with advantage. He thought that it was highly necessary that all udder diseases should be notified to the authorities, as there was great ignorance among farmers as to these respective diseases. On one occasion he was called in to inspect a number of cows, and found one suffering from mastitis, and upon his informing the farmer of the fact, that person declared there was nothing wrong with the cow because he had milked her himself. In towns cows were well kept as a rule, and as the milk was supplied quickly to the consumer, it was generally better than if it had journeyed a long way from the country, and had been contaminated with filth through all the various stages of transit. With regard to the method of ventilation, his ideal was to have a large flow of fresh air from below, with a small outlet above, so as to avoid danger from downward currents, In Sheffield the requirement was to have inlets or air grates, nine inches square for each cow.

Mr. Perryman (London) said that the very best and purest milk of the country might well be in a bad condition before it reached London or any other

great city, and therefore he thought more should be done in regard to refrigerating milk as it came from the cow. Far greater care than was ordinarily exercised was also necessary in keeping and storing milk in the home, where at present it was too often contaminated and infected. The percentage of cows with tuberculous udders was so small that the danger from such diseased animals was, comparatively speaking, small. The great and real danger lay in the contamination of the milk on its way to the consumer. It was of little use to talk of the better production of milk, unless they were prepared to have thorough inspection. The Dairy Acts should be made compulsory, and any cow with any ailment of the udder should, as a matter of course, be subjected to the tuberculin test. He believed that there was better milk supplied in the towns than in the country, because the sanitary conditions were better looked after, and the milk reached the consumer much sooner than in the other case. In the case of milk being brought to London, or any large city, he thought that medical men should emphasize the necessity of having it sterilized.

Professor McLauchlan Young (Aberdeen) explained that his statement as to the danger from infection being over-rated, referred entirely to the danger arising from diseased meat, and he certainly did think that danger had been sadly over-rated. He did not think it necessary that all milk should be boiled; to advise that, was nothing short of the outcome of hysteria. If there was thorough inspection there would be no need for the sterilization of milk, and if such a conference as that were to recommend wholesale sterilization, he thought the results would be unfortunate. What should be aimed at was to stop the source of a milk supply capable of causing disease, and so to effectually remove that cause.

Professor Woodruff (London), in reply, observed that he had had no intention of maligning the poor cow. His object in the paper was to prove that attention to the milk supply would reduce the danger from tuberculosis, and lessen the infantile death-rate throughout the country. In support of this view there was a mass of statistics to which he might have referred. In a paper read before the Sanitary Institute Congress at Bradford last year, Dr. McCleary had stated "that the mortality of infants in Battersea during the last six months of 1902 was 87·5 per cent. higher than the mortality in the (milk) depot-fed children." In Chicago since the Health Department had undertaken the supervision of the milk supply the death-rate of children under five years of age had fallen 5 per cent. Surely those figures afforded the strongest incentive to health administrators to energetic action, in order to secure the efficient control of the milk supply throughout this country. Several references had been made to American methods, and there could not be the slightest doubt that an enlightened control of the milk supply was in force in many towns of the United States. At the municipal milk station on a farm close to the city of

Rochester, N. Y. S., the milk was obtained under the best possible conditions from healthy cows, and of the milk prepared in that way, 43 daily samples were found to average not more than 14,000 bacteria per cc, while the city milk for the same period approximated to 235,000 bacteria per cc The milk commissions of the cities of Philadelphia, New York, and Chicago, were specially worthy of attention owing to the high standard of purity in milk which they not only demanded, but obtained. In Philadelphia the Milk Commission of the Pedriatic Society required the high standard of not more than 10,000 germs per cc., before they granted their certificate, while in New York the standard was fixed at 30,000 germs per cc. As to the question of air-space in cow-sheds in town and country, all the authorities were agreed that if one wished to see the most insanitary conditions in byres, one would have to go to the country districts. If Dr. Wilson would take the trouble to look at the conditions of things in the Manchester district, he believed that gentleman would admit that under the present regulations milk, to be reliable, must be produced in towns. With regard to the remark of Mr. Perryman on the small percentage of cows found in the London district with tuberculous udders, he would remind the conference that that was a state of matters after a system of inspection had been enforced, and he had given the actual figures in his paper by way of proof of what could be done by efficient inspection and supervision, which he now contended should be compulsory and uniform throughout the country.

PUBLIC ABATTOIRS & THE UTILISATION OF CONDEMNED CARCASES.

By LOUDON M. DOUGLAS.

ABSTRACT.

THE reader of the paper, which was illustrated by means of a large number of lantern slides, pointed out that the construction of public abattoirs in the United Kingdom was in a very backward state, and there were very few constructed on modern lines so far as plant is concerned. None had such appliances as those necessary for the utilisation of condemned carcases, and we had to look to the Continent for places so equipped. Abattoirs were very desirable things, inasmuch as it was reasonable to suppose that animals would be much better treated before slaughter, and slaughtered with greater humanity. Public opinion insured this being done. There would also be the salutary influence of a trained inspector ever present; obviously, also, the avoidance of nuisance, which was incidental to the system of private slaughter-houses. Families could not live in a decent way if the slaughter-house formed part of the dwelling-house. Abattoirs are meant for the slaughter of animals in a humane and proper manner, and when properly constructed would lend themselves to the efficient inspection of our most important food supply. Not only was danger suspected from our meat supplies, but it had been proved long ago that many diseases were transmitted from diseased meat to the human subject, which under ordinary conditions were preventable. The methods in use in the United Kingdom for the slaughtering of animals were not up to date, inasmuch as masks and humane killers were not in general use. This seems to be a matter that requires remedying, for if the practice of slaughtering animals could be efficiently carried out in Continental countries, there is surely no reason why the same practice should not be carried out in the United Kingdom. The strongest argument for public abattoirs lies in the fact that efficient inspection is possible, and only then becomes possible. When animals are found to be diseased in private slaughter-houses there is a danger that the meat will be circulated and

cause much injury, whereas in the public abattoir it will be promptly condemned. Condemnation of diseased meat does not necessarily mean its total destruction, and it was strongly urged that modern scientific apparatus, which was easily obtainable, should be introduced into every abattoir with a view to utilising such condemned meat in a hygienic manner. The total cost of putting up such an apparatus would be a mere trifling one to the community, and would insure the very best use being made of condemned carcases, and at the same time the residues would be treated so as to yield a profit. There was no profit to be made out of either burying or burning condemned carcases, whereas a certain profit could be made by the use of modern scientific apparatus. The great value of this apparatus (the construction of which was illustrated in great detail) consists in its being able to work up the condemned carcases in an innocuous way; the resulting products being dry meal and fat, which can be used for industrial purposes.

MR. JAMES KING (London) pointed out that it is a most difficult matter to get rid of the refuse of public abattoirs, especially when that refuse is collected at the rate of hundreds of tons in a year, and represents a direct loss. The same remark applied to diseased meat, and he therefore thought that the paper was a timely one, and would be welcomed by all who had anything to do with public abattoirs. There was, however, one remark of Mr. Douglas to which he was compelled to take exception, "The methods in use in the United Kingdom for the slaughtering of animals was not up to date, inasmuch as masks and humane killers were not in general use." His candid opinion was that the Continental workman was not as good a workman as the British butcher, and therefore had to resort to all sorts of patents and appliances to assist him. Shooting appliances were good enough in the case of docile animals, but he would like to ask what they would be like in the case of a Highland bull. They would be a complete failure, and he had had on several occasions to report unfavourably on them. In the hands of a competent man the pole-axe was the best instrument that could be devised. But it was an entirely different matter when the instrument was used by an untrained and unskilled man, and therefore he favoured a system of registration and licensing of competent killers by the authorities. Much the same thing applied in the case of slaughtering sheep. There was more cruelty in using the mallet than in sticking, and the question of time had also to be considered. A man had frequently to kill sheep at the rate of half-a-dozen in a couple of minutes, and there was really no time for methods which after all served no good purpose. He was of opinion that the solution of this problem was that only licensed and

efficient men should be employed in slaughter-houses. In London they trained their men, and gave them every opportunity and encouragement to become efficient killers.

Mr. J. L. Lloyd (Sheffield) stated that he could endorse much of what the last speaker had said in regard to the use of the pole-axe. He had once seen it very effectively used on the nape of the neck, the one man tickling the animal while the other dealt the blow, which was effective, while the action was quite unseen by the animal. Mr. Douglas had omitted to mention the probable cost of the apparatus necessary for destroying abattoir refuse. Gelatine was one of the by-products obtained by the German method of dealing with abattoir refuse, and if so, there ought to be a good market in this country for that article. Something ought to have been said as to the profit and loss side of the question.

Professor Dewar (Edinburgh) supported Mr. King in his view that British methods of slaughtering were more humane, or at least not more cruel, than the usages of foreign countries. He doubted very much whether the method of sticking sheep were really more cruel than that of knocking down. If the instrument used were sharp, the whole operation was so quickly over that it was doubtful if there was any sensation of pain in the animal at all. He could only smile when he thought of some of the slaughtering devices that had been put on the market. With regard to the question of tuberculosis in cattle, he thought the conference might well emphasize the necessity of preventing the disease by putting a stop to breeding at farms where it was known to exist. Let them bring all possible pressure on the Government to show the necessity for arresting the development of the disease among the herds.

Mr. James Munce (Belfast) observed that in his capacity as an engineer he had inspected most of the abattoirs in the country, and he had to acknowledge that he had been disgusted with what he had seen in almost every instance; they were bad, and not to be compared to similar institutions on the Continent, especially those in Germany. The amount of cruelty that was perpetrated in British abattoirs was appalling. Abattoirs in the United Kingdom seemed to be wrongly planned; they were merely patches of buildings of the most haphazard description. There ought always to be a central slaughtering hall, and the animals should be brought in at one side where there was neither sight nor smell of blood; and everything should be done inside the abattoir under the supervision of some properly-appointed authority. At Barmen, in Germany, he had visited an abattoir which was quite hygienic, there being no disagreeable smell, everything was clean, there was plenty of air-space and none of the disgraceful overcrowding which characterised the home abattoirs. In English slaughter-houses he had seen cattle standing up to their fetlocks in blood, shivering as they watched other

animals being killed, and conscious that their own time was coming. Abattoirs were badly constructed, badly ventilated, and badly drained. There should be a surface drainage which would admit of proper cleansing.

The President (Professor J. M'Call, Glasgow) thought that continental methods were much in advance of English methods. With the system adopted abroad, by the Bruneau method any bullock could be brought down by one or two, or at most by three blows, and personally he thought he could guarantee his own ability to do that. In this country he had seen as many as ten blows required to bring down a bullock, and they would agree that was not a pleasant or a desirable sight. He did not see that there was any difficulty in putting on the mask. The Bruneau method simplified killing, and he was much in favour of its adoption here.

Mr. Loudon M. Douglas (Putney), in reply, expressed his acknowledgments at the remarks which had been made, and referred to the value of commodities produced from the refuse of abattoirs. In Hamburg they made a profit from the by-products, but apart from that he strongly recommended the adoption of up-to-date methods of treatment on the grounds of hygiene and sanitation. The cost of the apparatus would of course depend upon its size, but he believed that something like £800 would be required to work successfully a town as large as Sheffield. He explained that Mr. Munce had been associated with others on a commission to report on the different methods of slaughtering, and he would very strongly recommend any one interested in the matter to read their report, which was a valuable contribution to the literature of the subject. Personally he recommended the use of the Bruneau mask, and considered it was a great advance on the old method of knocking down. Like some of the speakers he, too, could tell of gruesome scenes in the slaughter-house, but he was not sure that they could be pictured with any advantage.

Professor J. M'Call (Glasgow) intimated that he had a resolution to bring before the conference which he believed would be acceptable to them all. It had been framed in accordance with his own experience of city stabling, and in his opinion advocated a reform which was much desired. It was "That it be a recommendation from this Conference of Veterinary Inspectors to the Council of The Sanitary Institute that the time has now come when authority should be given by the Board of Agriculture to local authorities for the licensing of stables in large towns."

The recommendation was carried unanimously.

THE COMPARATIVE STUDY OF CANCER.

By E. F. BASHFORD, M.D.,

Imperial Cancer Research Fund.

A FEW years ago Professor McFadyean was obliged to protest against the assertion of a distinguished member of the medical profession that cancer was a disease limited to man. Veterinarians have described in the domesticated mammals practically all the forms of malignant new growths recognised in man with the exception of what is known as deciduoma malignum or chorio-epithelioma, associated with pregnancy. It is also very doubtful if an authentic case of cancer of the uterus has been described in an animal.

It now seems probable that a liability to some form of cancer is one of the conditions under which the life of all vertebrates is passed. If allowance is made for variations in the minute and gross anatomy of the vertebrates, cancer presents the same fundamental characters in all the animals in which it occurs. It also exhibits a curious contrast to the infectious diseases common to man and animals, in that, with identity in the nature of the disease and in its manifestations in various species, there is an entire absence of transmissibility from an animal of one species to another individual of a strange species. Further, cancer as cancer produces no symptoms which are peculiar to it, such as characterise the reaction of the tissues, or of the organism as a whole, to various infective agents.

We must therefore look upon the cases of cancer which present themselves sporadically in different vertebrates as having no connection with one another, as having arisen "de novo" in each individual in which they are found. These are some of the considerations which have sprung from studying cancer from the comparative standpoint, which, together with the results of experimental and biological investigations, promises to give a new impetus to the investigation of cancer. The problem as it presents itself at present is how, when, and why malignant new growths arise "de novo" in the course of the life of many vertebrates.

Benign new growths behave as independent parasitic organisms,

Everything which characterises a benign new growth as an independent organism is also characteristic in enhanced degree of a malignant new growth. It is not proposed to discuss how and why malignant new growths arise, but only to draw your attention to the time when they come under observation, which of course may be a very different thing from the time at which they have arisen.

One of the fundamental characters of cancer, especially carcinoma, is that it shows a curious predilection for the later adult and old age periods of life in man and in all the various species of animals subject to it. Although this is now a well known fact, I venture to draw the attention of the veterinary profession to it, because associated with it there is a question to which only the veterinary profession, to the members of which the Imperial Cancer Research Fund is already greatly indebted, have the opportunity of giving the answer, by helping to accumulate the necessary facts.

The duration of life varies greatly in the species subject to cancer. Old age is therefore attained quickly or slowly, if the absolute number of years be considered. Cancer is an identical process in all animals, and shows itself at a time which is in direct proportion to the varying durations of life, and is therefore definite and different for each species. These relations of the cancer ages to the durations of the span of life indicate the important dependence of the development of malignant new growths as a whole, upon circumstances innate in each species of organism, and on the laws peculiar to and controlling their growth. At present we can only draw this general conclusion, and speculate as to its cause and its coincidence with the wane in reproductive activity.

We require more information. Even in the case of the most common domesticated mammals we have no data extensive enough to permit of an instructive comparison of the relative frequency with which different animals suffer, nor which allow us to single out the sites of greater susceptibility, or determine whether these are the same or different in various animals, and in the two sexes. Epithelioma is the form of new growth of which the Imperial Cancer Research Fund has received most specimens. Many of these have come from the horse, cattle, dog, cat; also from the hen, and some doubtful cases from the trout.

It appears to me, however, that one is not justified in assuming that epithelioma is relatively more frequent than other forms of cancer. The apparent frequency of epithelioma may be only a consequence of its occurring on surfaces where it is more easily observed than internal cancers which are only likely to be found in numbers when numerous post-

mortem examinations are made. This view receives some support from the fact that in the case of those domesticated mammals which are slaughtered for food and the carcases submitted to meat inspection a larger number of internal cancers have been received. The noteworthy omission of the sheep, goat, and pig may not represent an insusceptibility to epithelioma in the case of these animals.

All the cases of epithelioma above referred to have been obtained from relatively old animals. All the tumours received by us from sheep, goat, pig have been from relatively young animals. In the case of the animals slaughtered for food, viz.: cattle, sheep, pigs, etc., for slaughtering they are preferred at the youngest age which yields profit, *e.g.*, 53,482 pigs were slaughtered in Glasgow in 1903. The average age of these was 6—12 months. No case of cancer was found. This does not prove that the pig is relatively exempt from cancer, and I put the question—will no case of cancer be found if the carcases of 50,000 old pigs are examined with the same care? In the case of the cow, considerable numbers may be kept to higher ages for milking and breeding purposes by poorer people, *e.g.*, in Ireland. We can segregate cows into groups of younger and older animals, and where this segregation is possible, *e.g.*, in Glasgow, we find a preponderance of cancer in the latter group.

Is the presence or absence of a considerable proportion of middle-aged and old individuals the only factor which determines the frequency with which cancer occurs in different animals? Or are there really species of domesticated and wild animals among which even with a considerable proportion of aged individuals cancer is not to be found? If such animals exist, the reasons for their natural exemption, or for the natural exemption of any of their organs, from cancer may be of theoretical and practical importance.

Even in man, where cancer has been longest known and is still most frequently recorded, only a proportion of the total number of cases is recognised. This proportion approximates more nearly to the absolute number occurring, in accordance with the thoroughness with which cancer is looked for. Many cases are discovered only in consequence of post-mortem or microscopic examination. Under the conditions of human life it is unreasonable to expect that all cases of cancer will ever be brought to light, we have to be content with an approximation to the total, with the recorded frequency as distinct from the absolute frequency. Theoretically we could arrive at the absolute frequency were it possible to have such an extensive series of autopsies that the subjects could be distributed in the age proportions characteristic of a standard population.

In the case of domesticated animals, more especially those which are slaughtered for food, and therefore subjected to meat inspection, the machinery necessary to detect the absolute frequency of cancer among them already exists, if the meat inspectors and their assistants know how to recognise cancer. So far as I am aware the careful systematic meat inspection conducted under Mr. Trotter's direction has done more to give us a true idea of the relative frequency of cancer in animals slaughtered for food than the work in any other abattoir. Conditions which are impossible of attainment in the case of mankind are practically obligatory in the case of all animals slaughtered in public abattoirs where the carcases are submitted to skilled post-mortem examination. The results obtained in the Moore Street Abattoir, Glasgow, under the able direction of Mr. A. M. Trotter, show that the machinery for meat inspection is sufficient to give most valuable information on the comparative age, sex, and organ incidence of cancer in *e.g.*, cattle, sheep, and pigs.

There is one other point on which skilled meat inspection can yield most valuable information. It is recognised that castration prevents the acquisition of the secondary sexual characters, prolongs the period of growth, and generally delays the tissue changes which distinguish younger from adult and older individuals. The sexual organs have a profound influence on the body, and it was natural that their possible influence on cancer should receive attention. Dr. Beatson, of Glasgow, was the first to perceive that the removal of the ovaries in inoperable cancer of the breast in women sometimes had a beneficial result. During the past year we have examined a number of cancers obtained from geldings, and from castrated or spayed cattle, dogs, and cats. This shows that the simple absence or presence of the *normal* internal secretion of the reproductive organs cannot determine the initiation of the cancer process, nor is the presence of an *abnormal* secretion by the reproductive organs a necessary preliminary condition. These possibilities are excluded by the occurrence of cancer both in the presence and in the absence of these organs themselves. I have already pointed out the curious coincidence between the time of the maximum tendency to cancer and the period of waning reproductive activity. This may or may not be only a coincidence. In the course of meat inspection it is possible to determine whether the age at which cancer tends to occur in spayed or castrated animals is earlier or later than in entire animals, and these data will give the first reliable indication of whether or not the reproductive organs exercise any influence in determining the coincidence of the higher cancer rate with later adult life.

The extent to which careful meat inspection in Glasgow and fish inspection in Nottingham and at Billingsgate have been responsible for the detection of cancer in animals destined for food consumption has been emphasised. There can be no doubt that the inspectors at abattoirs and fish and poultry markets will in future detect cancer and the facts associated with its occurrence more frequently if they will only look for it. The Imperial Cancer Research Fund will most willingly continue to examine and report on the nature of tumours from all animals if the age, sex, and animal are stated, together with information as to whether the animal was castrated or entire. In drawing special attention to the carcases of animals killed for food, I should not omit to state that equal importance attaches to data from the horse, dog, cat, and any other animal whatsoever.

I have tried to point out to you some matters on which the veterinary profession can supply valuable information, and by doing so place the public and those whose duty it is to investigate the nature of cancer under great and lasting obligation. The members of the veterinary profession have the opportunity of obtaining this information, and that the present machinery is adequate to yield valuable results the facts brought to light in the Glasgow abattoirs have fully demonstrated. More extended observations of the same kind may contribute materially to the relief of human suffering.

CONGRESS AT GLASGOW.

CONFERENCE OF SANITARY INSPECTORS.

A PLEA FOR THE CONSOLIDATION & AMENDMENT OF THE PUBLIC HEALTH ACTS.

By JOHN H. CLARKE.
(Member).

ABSTRACT.

A PAPER calling attention to the many anomalies and difficulties arising out of the multiplicity of Acts of Parliament dealing with questions affecting Public Health, urging the codification of these laws in the near future, and the appointment of a Minister of Public Health with a seat in the Cabinet.

WHAT THE PEOPLE SLEEP UPON.

By PETER FYFE, F.R.S.E.

IT has been said that "there are combinations of evil against which no human energies can make a stand." Combinations of evil, at all events in a sanitary sense, seem peculiarly attachable to a certain class of the people. It is this class I had in my mind when I put down the word "people" in the title of the present paper. The major part of the people in this city are composed of those who nightly sleep in houses of one or two apartments. The most of them dwell in this limited space because they cannot afford to pay for more. Poverty compels them. The com-

Note.—The Proceedings of this Conference commenced with an Address by T. F. Strutt (*see page 329*).

binations of evil which dog the heels of poverty anywhere, but especially in the welter of city life, are only really known by those who day by day go down among it; and even *they* would need a microscopic eye to see the causes of the evils there. We see diseases the origin of which we cannot trace; they spring up here and there in apparently unconnected series, and science, baffled, labels them sporadic. They linger persistently in the poorer quarters of the town, and the prescription of preventive medicine (cleanse the houses, flush the drains, hose-wash the courts, limewash the ashpits, and all the other hygienic formulæ), appear to fail as a panacea for them. Enteric, dysentery, diarrhœa, seem as busy as ever among the people autumn after autumn. To me it has always appeared unaccountable that, with a wet climate, an irreproachable water supply, daily supplies of uncontaminated milk, a closely-guarded meat and food supply, a reasonably perfect sewage system, and gigantic cleansing operations continually proceeding, we should still witness the sufferings of the people from obviously preventable diseases such as I have named, and others I have not named. It may be that every weapon which bacteriology and chemistry can arm us with will fail to bring our elusive enemies within striking distance, but it appears to me that one of the duties of sanitary inspectors is to be also sanitary suspectors, and to leave no covert unsearched and unbeaten in which these enemies may be lurking.

It was in such a frame of mind I happened to be, when, in the company of friends fully a year ago, one of them, who was in the bed-making trade, began to speak of some new pine-fibre material he was introducing to this country, which would be cheaper and healthier than hair to sleep upon. The conversation soon turned upon the whole question of bedding material, and this expert's opinion was that much of the material of which beds were made, and particularly wool-flock, with which also chairs, sofas, and cushions were stuffed, was of a most objectionable kind. I determined to make some investigation into the subject. This Congress of The Sanitary Institute seemed to offer the chance of a wider publicity for its consideration than any local meeting could; so, I proceeded to collect some special information on what the poorer of our people sleep upon. I called to my aid some makers of common wool-flock, wholesale vendors of this material, some of the sanitary staff (male and female), and, finally, the Corporation Chemist, Mr. Harris, and the City Bacteriologist, Dr. Buchanan; and to all I have been much indebted for their hearty co-operation. Let me now present you with a brief statement of the proceedings which were taken, and the facts which have been brought to light.

I think you will agree with me that the existing state of affairs is most deplorable, and that this conference of sanitary inspectors from the four corners of the United Kingdom would be wanting in appreciation of the magnitude of the evil, if it did not unanimously call upon the Council of the Institute to earnestly press upon the Government the need for immediate reform.

The first proceeding was to discover the truth with regard to the exact nature of this wool-flock. I accordingly visited the works of several makers of it in this city. There, in the middle of February, I witnessed in each place the conglomeration of filthy rags, the offcast of every class of the population, from the wealthy of the West-end to the tramp and vagrant of the East. I examined certain individual parts of the material which was to be made by the "Devil" into bedding for the people. I may explain that this is the appropriate name given to the machine which performs the laniary process.

To explain to you, in Parliamentary language, what I observed on some of the torn garments would be impossible. It is better left to the imagination. Only those pieces, soaking wet or too damp for the "Devil" to tear into shreds, were cast aside to be stoved, either beside the steam boiler or in a special drying chamber heated by steam. Nothing in the nature of cleansing or disinfection is attempted. All goes into the machine if sufficiently dry. At the other end it comes out as flock, shredded so finely by the spikes or teeth on the periphery of the drums as to appear as fluffy wool of a dark grey, black, or brown hue, depending on the colour of the rags passing through the machine.

I show you here, in a glazed wooden case, the various kinds of flock used as bedding, 12 in number, and the wholesale prices of each class. I will refer to the contents of the case later on.

The great mass of dust and finely-powdered filth which is set free by the "Devil" is blown by a fan attached to it into a dust chamber, out of which much of it finds its way into the surrounding atmosphere.

From one of the factories I secured in February last fully a pound of the flock as it came from the machine. At the sanitary office I weighed off half a pound. The corporation chemist gave me two Winchester jars of cold distilled water, in which I twice rinsed this quantity. The first rinsing was in 2·09 litres, or ·45 of a gallon, for ten minutes; and the second rinsing in the distilled water of the second jar, containing 2·5 litres, or ·55 gallon, for an equal time. These two samples of defiled water were then handed to the corporation chemist for analysis.

In order that you may be able to grasp the extent of the filthiness of this bedding, the chemist, at my request, has placed underneath, on the third row, the corresponding analysis of average Glasgow crude sewage for the quarter ending 29th February. Under every heading the bedding shows very badly, as compared with the sewage. Expressed in grains per gallon, the sewage contained ·816 of free and saline ammonia, against 1·924 grains in the rinsings from half a pound of the flock. Of albuminoid ammonia, against ·236 for the sewage, we have 2·002 for the flock. The oxygen absorbed in four hours at 27° cent. by the sewage was 3·811 grains, against 13·840 grains for the bedding; of chlorine, 12·6 for the sewage, against 22·4 for the bedding.

Now look at the total suspended solids in the crude sewage, as compared with those found in the two rinsings of this half-pound of flock. For the average sewage we note it is 24·4 grains per gallon, while in the bedding rinsings it reached the alarming figure of 227·07 grains per gallon. You will observe that, even the second ten minutes' rinsing of the flock contained almost three times more suspended solids than had been found in the sewage.

I will not weary you with further comparisons (the tables tell their own dreadful story), but I finally direct your attention to the last column, in which you will see that the suspended solids rinsed during twenty minutes from the flock formed 3·12 per cent. of the whole.

In case it might be urged in criticism that the material I secured at this flock-making factory might have been of a specially filthy character, I caused a new flock bed, bolster, and two pillows to be purchased on the 10th of May from one of our largest City house furnishers. I first shook and beat the bed on a clean dust-free floor, in order to ascertain if the dried dust and filth could come through the ticking. I found it did so, showing that the tick permits a considerable quantity to escape whenever the bed is shaken or made.

I then sent the whole up to the Sanitary Washhouse at Ruchill, with instructions to the manager to clean out one of the machines thoroughly, weigh the wool-flock very carefully, and then rinse it for half an hour in pure cold water. He did so, and sent me the result as follows:—

The two pillows contained 4 lbs. 10 oz. of flock; the bolster, 5 lbs. 4 oz.; the bed, 32 lbs. 3 oz.; or 42 lbs. 1 oz. in all. After half an hour's rinsing in the machine, the flock was taken out and dried. It was again weighed most carefully, coming out at 40 lbs. 2 oz.; thus showing a loss of 31 oz. (almost 2 lbs. avoir.), or of 4·86 per cent. of the total weight.

The contents of this new bed were, therefore, found to contain a greater percentage of solid matter than was found by the chemist in his half-pound of selected flock.

In order to present you with an ocular demonstration of the filth which was rinsed out of it, I asked the manager to slowly evaporate the rinsings until they could be contained in a Winchester quart bottle. The bottle is before you. This black, dirty-looking mass I pour out into a receiver on the table, so that any one may examine it for himself.

You see here a second bottle full of a clear brownish liquor. It contains some of the rinsings passed through filter paper, in order to show the amount of colour which is due to dye alone.

The third bottle shows you part of this filtration distilled, by which, it will be observed, a perfectly clear liquid is again obtained.

Having now satisfied myself as to the extremely obnoxious character of this description of bedding, I asked some of the male and female inspectors to make enquiries in the homes of the lower classes, for the purpose of ascertaining the kinds of bedding the majority sleep upon. About 2,300 houses in all were visited, in which special investigation was made into the composition of 3,163 beds. The following is the result:— Hair beds, 22; feather beds, 115; clean flock, 37; cotton clippings, 103; straw, 371; chaff, 39; shavings, 4; old clothes, 1; and common flock, 2,471.

Hence we find that 78 per cent. of the beds the common people nightly seek their repose upon, are stuffed with that most pernicious material. Why is this abominable material chosen? There can only be one answer: because it is cheap, and the people are ignorant of its real nature.

Twelve samples of flocks kindly furnished by a well-known English firm who manufacture all kinds were shown, and the price of each was clearly marked. I need only direct your special attention to the common unwashed flock (No. 3), sold at 4/6 per cwt. all over the country; and the better class, which is free from filth and is sold against it, namely, No. 7, called "grey millpuff," at 9/3 per cwt. I am informed by the makers that the millpuff is ground almost to a pulp, which is kept in a moving stream of pure water for three-quarters of an hour.

Now, assuming a complete bed and pillows contain 42 lbs. of material, the whole difference to the public between that clean-looking grey millpuff and the dirty unwashed wool flock, so much in use, is only 1/9¼d. per bed; while, if we take the washed woollen millpuff at 10/- per cwt., the difference is not over 2/- per bed. Beds are not purchased so often by the people as to make a difference of 2/- felt, even by the humblest, and, in

any event, it is clearly against the public interest that this vile material should be dispersed broadcast over the country. Even the makers of this stuff have conscience enough to reprobate its use. The owner of the factory, from which I took the sample, called upon me the following day, and in the conversation which followed, he stated that he had often wondered that its manufacture and sale were not put a stop to. He admitted it was a filthy and dangerous material, but he had to make it in self-defence, and even as it was, he was under-cut in price in the Glasgow market by manufacturers in Yorkshire. In conversation since with several bedding manufacturers, cushion makers, and chair and sofa furnishers, I found all were of one mind about it, but none dare decline to sell it for fear of losing business.

If anyone can still be found to support its continued sale, let me tell him what Dr. Buchanan, our city bacteriologist, has written me about it. I give you the report in his own words.

"Seven specimens of 'flock' were received from you for bacteriological examination on the 17th of February last. The specimens comprised seven different qualities of flock, as sent out by manufacturers for use in upholstering and mattress-making."

"In view of the fact, which has been demonstrated in our presence, that this material is frequently made from rags and cast-off clothing gathered from ash-pits, the bacteriological examination was undertaken to determine, from the number and kind of bacteria present, the amount of cleansing or disinfection to which the materials had been subjected in the course of manufacture."

"Cultures were made as follows:—A definite quantity by weight of each sample of flock, namely $\frac{1}{10}$ gramme, was thoroughly washed in 100 cc. of sterilised water. A definite volume (1 cc.) of the washing was diluted, so that the quantity ultimately added to the culture media represented the washings of $\frac{1}{10000}$ gramme of flock. The results are computed as the number of bacteria in the washings of 1 gramme of flock. The figures can only be taken as an approximate indication of the numbers present, as the simple process of washing could only set free bacteria approximately representing the whole number in the material."

"Two culture media (agar and gelatine) were used in order to determine growth at blood-heat, and the temperature of the air."

"The samples were examined on two occasions at an interval of about three months; and, while the results of the second examination show a tendency to diminution of the bacteria, they at the same time show a general agreement with those of the first examination."

"The experiments very clearly show that the different lots varied

either in original cleanliness or in the processes through which they had been passed. The results obtained with 'common unwashed flock' are what might be expected from material gathered from such a source as that already mentioned. They indicate an amount of uncleanliness in the form of live potential dirt that is shocking to contemplate, when one considers the purpose for which the material is used. In the other samples of the first set A., there is evidence of insufficient cleansing, and certainly no indication that any process of disinfection has been carried out. In the samples of set B. there is evidence, in the relatively small number of bacteria, of marked improvement. Taking sample B1, which may be compared with A1, there is such a wholesome difference in the numbers (10,000, say, as compared with 4,500,000), as to indicate, if not thorough washing, at least some attempt at disinfection. It may be mentioned by way of comparison that the average number of bacteria in the same quantity of Loch Katrine water for the year 1903 was 75, and that the average of 32 examinations of Glasgow crude sewage was no more than 197,500."

"The results of the examination reveal a state of matters calling for remedial action."

When we listen to this expert opinion, and look at the figures on the bacteriological table, which confirm those of our corporation chemist, it is with difficulty that we are restrained from giving vent to feelings of indignation that, as Executive Sanitary Officials, we have been for so long powerless to cope with a wide-spread evil, in every way calculated to bring disease into the closest proximity with our labouring population. It would be safer to sleep on a bed filled with sewage, than on this material, upon which, as I have shown, 78 per cent. of our humbler fellow citizens are nightly reposing.

The figures can only be suitably described as *appalling* in their suggestiveness, for again, remember that it is not only the 78 per cent. of our humbler classes who are in danger from this material in their homes, but every West-end lady who, with severe and unthinking economy, purchases one of these "cheap and nasty" beds for her servant, takes into her otherwise well-appointed home a centre of disease potentiality. Filth in or about the servant may mean disease in her household.

Finally, let me express the hope that, now the facts are known, the Government will lose as little time as possible in passing a measure which will enable all Local Authorities to *sample* bedding both in the premises of flock manufacturers and in those who *sell* beds, sofas, couches, and cushions, and that punishment may follow every sale of any such material

which does not conform to a certain standard of cleanliness and freedom from microbial impurity. What that standard may be I leave to the judgment of biological experts, but I trust we shall all be unanimous in the desire to see, at the very earliest date, a severe restriction put on the manufacture and sale of such material as I have had the honour to draw your attention to.

NOTES ON RURAL INSPECTING.

By T. BRICE PHILLIPS, Mem.Soc.Arts. (Associate).

THE marked tendency in sanitary circles to give more attention to rural districts is a noticeable feature in the growth of hygiene. Governing authorities of populous places recognize that the health of their districts is influenced by the sanitary administration of the neighbouring rural areas, which are often the sources of some of the food supplies of the towns. Rural district councils are also more alive to the importance of their own duties than formerly. Altogether it may be said that intelligent administration prevails in sanitary matters, the day having passed when it was considered a sufficient compliance with the Public Health Acts to appoint the village carpenter to give his spare moments to sanitary work. It may be of interest to sanitary inspectors at this Congress to observe and discuss some of the features typical of rural inspecting.

Distance is a condition of work which accounts for many of the distinctions between town and country inspecting. Whereas, in towns, the inspectors have their work confined within a small and compact area, the rural district necessarily covers a number of sparsely populated places, spread over a wide area. Consequently the number of inspections per inspector must be less, on account of the time taken in travelling, for it has to be borne in mind that much of the work is in outlying places, far removed from the facilities of railways. It could be shown, if time permitted, that many other distinctions arise from the same cause.

The varied nature of the work of a rural inspector may be gathered from the following list of the actual calls which came to hand by the morning post in a wide district:—

1. A medical man notifies three cases of scarlet fever in a parish nine miles from inspector's office.

2. The schools in above parish require disinfection, having been closed upon the outbreak of scarlet fever.

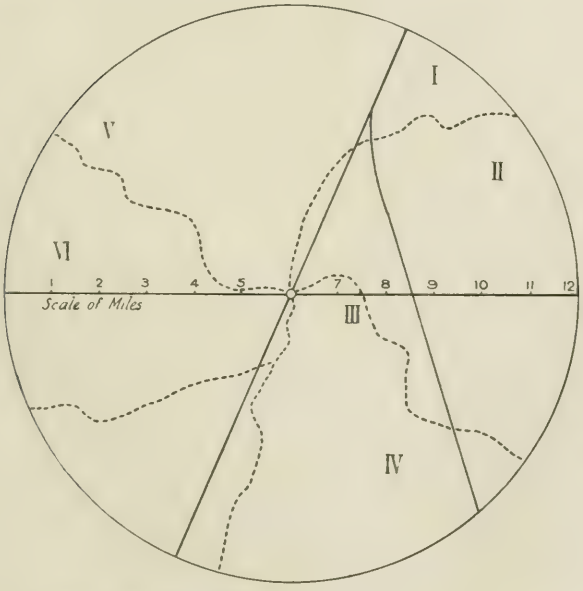
3. A medical man writes that it is necessary to remove a typhoid patient from school, where she had been taken ill, to her home, involving a road journey of several miles.

4. A householder complains of a nuisance arising from defective drainage.

5. One of the parish councils in the district calls attention to a nuisance in another village.

6. A ratepayer requests the inspector to call as soon as possible to inspect the water supply of a cottage.

If the above work lay within a small area it would not appear formidable, but as a matter of fact it involved separate journeys of nine, seven, and six miles, in different directions. The diagram indicates this, the circle representing the district referred to, which covers about 120 square miles, or practically a circle of 12 miles diameter, the inspector's office being near the centre. It will be observed that most of the places of call, shown in Roman numerals, are some distance from the main roads, indicated by dotted lines; whilst the railway, indicated in black lines, is almost useless, covering as it does but a very small part of the district.



Reference:—
Main Roads .....
Railways _____
Places of Call I II &c.

In addition to the daily calls, a great deal of routine work has to be given attention, such as the inspection of dairies, cowsheds, and milkshops, as required by the Local Government Board's orders; also of slaughter-houses; and of workshops under the Factory and Workshop Act, 1901. The recent Education Act has also resulted in the more regular inspection of elementary schools in rural areas, whilst there are numerous duties devolving upon an inspector in such districts under the various Housing Acts. In many districts, too, the offices of surveyor and inspector are combined, and it is a matter open to some discussion as to whether it is advisable to keep these offices separate or not. The Public Health Act, 1875, makes no provision for the appointment of surveyors for rural districts,* and the line of demarcation between the duties of the two officers is not so clearly defined in rural as in urban districts.

The writer has endeavoured in this note to briefly point out the character of the work of rural inspectors, in the hope that some discussion may follow as to the best methods of carrying on the work in actual practice.

RIGHTS AND RESPONSIBILITIES OF PROPERTY IN RELATION TO SANITARY ADMINISTRATION.

By WILLIAM W. KELSO,

Chief Sanitary Inspector, Paisley.

ABSTRACT.

THE right of ownership entitles the possessor to do what he pleases with his land or property, and even light, air, and water he can require to be protected for him free from pollution. No matter how great or how necessitous an undertaking may be in the interests of a large community —such as a water supply, or sewerage scheme, or putting down pipes to carry water or sewage—the rights of ownership cannot be interfered with unless by bargain or way-leave.

While the rights of property are thus protected and encompassed

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* Compare Sections 189 and 190 as to appointment of officers in urban and rural districts

round, what are its responsibilities in relation to sanitary administration, and how are they met?

Why should an owner of property not be punished by fine or imprisonment for allowing anything which constitutes a statutory contravention to happen or exist on his property to the sacrifice of human life? Is such an offence not more serious than most police offences which are so punishable? Or than that of a tenant or occupier who allows his house to become dirty or unwholesome? Or that of the person who sells adulterated milk, or other articles of food? Why are sanitary offences of property permitted to occupy this anomalous position in relation to other less serious offences?

But, while jealously guarding the rights, the responsibilities are shaken off, or let go, without a grumble.

How often has the attempt been made to saddle the public authorities with flushing of drains, and cleaning all traps in connection with drains, and surface traps in back courts? Now this is as clearly a proprietory duty and responsibility as is the upkeep and good order and repair of any other part of the property.

Nor is this throwing off of responsibility confined to the owners, for the tenants or occupiers are often just as ready and willing to be relieved of their duties, as for instance, the cleaning of back courts. This is a duty that some authorities have within recent times taken in hand, but on what principle, it is difficult to understand. It is surely as much a property or tenant's duty to clean the back court common to the property in which their house is, as it is to clean the passages, closets, stairs, or lobbies common to the house.

There are other respects in which I think owners of property have distinct grievances which ought to be remedied. One is the trouble and expense they are put to in getting rid of bad or undesirable tenants, under the present voluntary arrangement of monthly lets.

Should an owner be desirous of putting a tenant out, no matter what the grounds may be, and should the tenant refuse to remove, the present method of procedure for ejectment of such obstructionists is vexatious and expensive, to say the least of it.

In a matter such as this one would have expected that the owner would have been enabled to exercise his right over his property without being put to such expense, and in a more summary manner. Especially if it should be on the ground of a tenant keeping a dirty or insanitary house, a certificate from the medical officer of health, or sanitary inspector to that effect, should be sufficient for ejectment, within a week at the furthest.

It appears that the Magistrates in Police Courts have the power to grant such ejectments, which would simplify and expedite matters to some extent. But there appears to be a doubt whether the Magistrates must undertake this rather unpleasant duty, unless they please, for Edinburgh and Glasgow are the only two Magistrates' Courts in Scotland which have done so.

It is to this class of tenants that the policy of hustle should be applied, but it is evident that the law of ejectment requires amendment before there can be much hustling, even where it is desirable.

Nothing strikes deeper at the root of the great social and housing problems than the need for a greater measure of supervision over houses and property, and of interest in and intercourse with the occupiers. This would play no mean part in the great and much desired national reform in social and housing conditions.

Evidently the sanitary inspector is not to be trusted with such a work. Property owners do not look upon it as any responsibility of theirs. Are the conditions not about ripe for a voluntary system of social reform on lines of the Elberfeld or Leipzic systems? which are described by the fair writer of "Britain's Next Campaign." These systems are not wrought by officials, but by the people setting up for themselves a higher and nobler standard and sense of citizenship, and acting up to it.

Whether such a system is in this country to be made an owner's responsibility; whether it is to be made a public responsibility; or whether it is to be made a responsibility devolving upon each of us as our "brother's keeper," in whatever way it may come into operation, it cannot come a day too soon.

It is because one of the objects of this Institute and kindred organizations is to assist in promoting and watching the progress through Parliament of all legislation of a sanitary character, that I have submitted these aspects of the subject for consideration. However they may be viewed, it cannot be denied that there is need to strengthen the various working parts of our sanitary machinery, proved by experience to be deficient and unsuitable for coping with the work requiring to be done.

CONGRESS AT GLASGOW.

CONFERENCE OF WOMEN ON HYGIENE.

SOME HINTS ON THE MANAGEMENT OF INFANTS.

By Miss ISABEL G. SMITH.

ABSTRACT.

THE object of this paper is to discuss some of the mistakes in the management of infants which I commonly meet with in my visits to the houses of the poor, and to suggest how these mistakes may be remedied with the means available in such homes.

Clothing.—An infant's clothing should be *soft*, *warm*, and *loose*, and should reach from the neck to the wrists, and, for the first few months, about half a yard beyond the feet. What I commonly find, is a scarcity of flannel undergarments and a superfluity of starched, thin cotton robes; much too long in the skirt, but with low necks and short sleeves.

Bed.—The bed may be anything that is clean, safe, snug, and of sufficient size, so long as the baby has the sole right of entry. The mother's bed is *not* the proper place, both on account of the unwholesome exhalations from her body and the even more active danger of suffocation. Egg-boxes and banana-boxes, suitably draped with *washable* material, make useful cradles, and for bedding, the shavings in which eggs come packed from abroad, hay, fine straw, or chaff, can be sewn in a clean tick. When soiled, the contents are burned, the tick washed and re-filled.

Food.—The food supplied by nature is obviously the very best nourishment an infant can have; and when, for any reason, this cannot be

Note.—The Proceedings of this Conference commenced with an Address by Her Grace the Duchess of Montrose (*see page 338*).

had, the standard to be aimed at, is to get by artificial means a substitute as nearly like the mother's milk as possible.

The most easily obtained and generally satisfactory substitute is cows' milk suitably diluted. Cows' milk chiefly differs from human in that the curd is heavier and therefore less easily digested. To overcome this drawback, we dilute it with lime-water or barley-water. Lime-water, if used at all, should be given freely, and for many infants it is too astringent.

The true value of barley-water is that it renders the heavy curd of cows' milk more flaky and, therefore, more digestible. It is a common delusion that it is, in itself, very nourishing or flesh-forming, and all who visit amongst the poor should see to it that barley-water is not, as I often find it, being depended on as an actual food. It is also generally made much too thick. Barley-water decomposes very quickly, and should be made fresh twice a day in warm weather.

A very common and serious result of artificial feeding is the disease called rickets, which generally shows itself in the teething period. Apart from *unsuitable* food, I believe this complaint to be chiefly due to the absence of sufficient fat in the infant's food. Whenever possible, a teaspoonful of fresh cream should be added to each bottle of diluted milk; failing cream, useful substitutes are found in olive oil, cod-liver oil, fresh butter, or a small piece of mutton-suet shredded into the milk while scalding. Care must be taken not to cause nausea by giving too much fat at first.

Milk should be scalded in a double saucepan, or in a covered jar placed in a saucepan of boiling water. When scalded, the vessel containing the milk should stand, covered, in cold water until thoroughly chilled. If done in this way, no skin forms on the milk, and the cream is, therefore, not interfered with. Enamelled saucepans are dangerous from their liability to chip, the small sharp particles being easily swallowed.

When a young infant cannot digest cows' milk and water in the proportion of half-and-half, it is better to give condensed milk. Only the best brands should be used, and as even these are deficient in fat, extra cream should be added. Fresh cows' milk and water requires the addition of sugar; but the condensed milk commonly used has the drawback of being over-sweetened in the manufacture.

As regards the *manner* of feeding, the following rules are useful:—

(1) Observe strict regularity. For the first month or two, feed every two hours by day and once or twice in the night. As the quantity taken increases, the intervals should be lengthened.

(2) An infant, while being fed, should be held in the natural position,

and the meal given in from fifteen to twenty minutes. Do *not* lay a baby in its bed with its bottle.

(3) The "bottle" used should consist of two parts only, viz., a "bottle" and a teat.

(4) Absolute cleanliness is essential in everything connected with an infant's food, as indeed in all its surroundings.

THE PHYSICAL TRAINING OF WOMEN AND GIRLS.

By ELIZABETH PACE, M.D.Lond.

THE question of the physical training of women and girls is one which must interest us all very deeply. The conditions of women's lives are changing, and have been changing rapidly for some years past, and with the difference in women's lives comes the demand for a corresponding change in girls' education to fit them for the future. Only the girl who is prepared by a sound physical education to meet these different conditions will be fit to do her duty to herself and others, and to get from life the amount of happiness which every man and woman is entitled to expect. For married women perfect physical condition is of the first importance, for the comfort of their homes, the welfare of their children, and of the nation generally, depends on it. For unmarried women, following the various professions, the need is almost as great, for only by good health can the strain of professional life be met.

We are powerless to stop the stream of middle-class women taking up professional work, this depends on a social condition over which we have no control; but by taking care that physical culture plays a large part in the preparation for this life we can be sure that women make a healthy start, and that they have learnt the value of keeping the body in good condition, if the best work is to be done.

For girls and women the physical exercise required is different in quality and degree. I will deal first with the training of girls, then

shortly with the need for keeping this up to some extent after the girl has left school.

The work of the Royal Commission on Physical Training (Scotland) has been so splendidly done that it might reasonably be supposed that the last word on the subject had been said. At the time that the commission was sitting, however, I was struck with the fact that the witnesses examined on the subject of girls' schools were all those who had knowledge of girls of a class attending higher elementary schools, with the exception of one or two heads of schools for girls in a better social position. As my personal experience has been chiefly confined to girls of the class who would attend high schools or good boarding schools, I would like to say something more especially about their needs.

We probably are all agreed that, although much has been done of late to obtain good physical training for girls in all classes of schools, very much remains to be done. The report of the commission shows us how very little time is allotted to drill or exercise in the elementary schools. The time ranges on an average from $\frac{3}{4}$ of an hour to $1\frac{1}{2}$ hours per week. It seems almost impossible to believe that any good could come of spending $\frac{3}{4}$ of an hour per week in drill except as an education in training the power of attention. In the poorer schools the children are often tired when they come to school, having already done a certain amount of work at home; they have probably had insufficient sleep, and often insufficient food. If, however, children are too tired to take part in daily drill and exercises, and are not well enough fed to take part in games, they are not fit to be taught any lessons. In the better schools there is the great difficulty of want of time. It is a very anomalous condition of things that our children in industrial schools should be better off in this respect than children of poor but respectable parents. The fault does not lie with the teachers, but in the overwhelming burden of work laid upon the children by the code. A code which would give us a daily programme of half an hour's gymnastics, and half an hour's spontaneous play in the midst of the school-work, would be the greatest boon, not only to the children's bodies but to their minds.

In the High schools fashion has done a great deal for us of late years. Very many of the good middle-class and higher schools have a gymnasium, or arrangements for gymnastic classes, and many have a playing-field. But even in this class of school there is still much to be done before all of them give a good physical education.

The *German system* of physical exercises includes training in free exercises, of use of bar-bells and wooden dumb-bells, drilling, and the

use of gymnastic apparatus of all kinds. I saw a class of boys at work in a German school two years ago, and was struck with the development of muscular power; but it seemed to me that many of the exercises were too severe for some of the boys, and there was no system of inspection to exclude the physically unfit boys from the class.

Purely military drill in use in some schools is unsuited for girls.

I believe that for girls and women the Swedish system is the best. It should be taught them by fully trained women teachers, whose own training should include some knowledge of hygiene and physiology, so that they may be able to recognise signs of fatigue in the pupil.

Among the most important of the Swedish exercises are the breathing exercises. These tend to develop chest capacity and to prevent anæmia.

To obtain the best results there should be a daily gymnastic class for each girl; half an hour is long enough, and we must remember that this half hour is not recreation. The brain is used while exercises are being learnt; until they become automatic, a great deal of concentration of attention is required. This is useful as an education, but it means that the gymnastic class must be regarded as a *lesson* and not as play.

It is very important to remember this, and not to urge a boy or girl who has too much brain work to go in for gymnastics as a relaxation. In order to thoroughly profit by a gymnastic class the girl must also be physically fit and properly dressed, and the class must be held in a suitable place.

(*b*) *Exercises for correction of morbid conditions.* In this direction we have a most useful means of helping a growing girl. It very often happens that, owing to a faulty position in the desk or to some equally unsuspected cause, a growing girl suffers from lateral curvature of the spine. This, if not very marked, can be remedied during school hours by appropriate exercises given daily. The same may be said of flat foot. Breathing exercises may be used in the same way to counteract a tendency to shallow breathing and round shoulders.

All this would necessitate medical supervision, but so beneficial would it be to the girls who need it that it would be well worth the extra expense to provide it in the elementary schools, where children would certainly get no help of the kind unless it came through the school. I am quite sure it would be welcomed by parents and teachers.

Games are chiefly recreational in value, but they are also educational. Girls, as well as boys, need to learn to keep their tempers, to stand by one another, and to take bad luck as well as good with equanimity. Nothing teaches all this like games at school.

It is of the greatest value to the girls when the mistresses take part in their games, and the ideal arrangement is to be found in many high schools, where the gymnastic mistress is also the games mistress.

For many years I have acted as medical inspector to the St. Margaret's Girls' School at Polmont, and the work there has led me to believe that every school girl should be seen by a doctor at least once a year. We adopted the schedule used by Miss Julia Cock, M.D., at the North London Collegiate School for Girls, and have found it most useful.

Every new girl is examined, unless the parents object (which very seldom happens), her height, weight, and age, chest measurement and expansion, noted, also the condition of the spine and feet, the eyesight is roughly tested, and the condition of the throat and teeth are also noted. Any special peculiarities of constitution are entered in the health register, and the list of games and gymnastics is marked for each girl. Most of the girls, of course, play all the games and take all all the exercises; any girl, who for any reason is not fit for violent exercise, has hockey and the severer gymnastic exercises stopped for the term. These are usually girls who have had influenza or some debilitating illness in the holidays. Girls who have outgrown their strength are put in the same category till they recover, greatly to their own annoyance, but to the benefit of their health. The inspection is useful in another way, girls who are generally poorly developed, and who are suffering from any constitutional weakness, have their time specially planned for them by the head-mistress, who makes the lessons entirely subservient to their physical welfare.

If it were possible to introduce some inspection of the sort into elementary schools it would be of the greatest value to the girls. Such minor deformities as lateral curvature would be detected, girls with flat chests and round shoulders could be given special exercises, and where any remediable defect was discovered the girl could be referred to the family doctor for treatment, or in the case of the poorest children to the infirmary dispensaries.

Exercise for women.—For women the needs of physical training are different. Growth is finished and exercise is needed, not so much as an aid as to help the circulation, respiration, and to keep up muscular tone. Unless required to correct morbid conditions, gymnastics are not so necessary for women as girls, indeed, it is not easy to persuade women to take them when necessary. Still, it must be kept always before us that some form of regular exercise should be aimed at. Walking, golfing, cycling, all these exercises are better suited to women than the more

violent games, though for women who are constantly in training tennis and hockey are excellent.

There is one very important point on which I must touch. For any form of exercise both men and women must be physically *fit*. We must remember that exercise which produces more than a healthy fatigue does no good and may do much harm. Brain workers often make the mistake of violently over-exerting themselves in their short free time. Spasmodic exercise can be worse than none at all. What we have to aim at is regular steady exercise. If we can afford a horse or a bicycle, so much the better; if not we must walk, and walk every day. As we get older walking is the best of all exercise. It is a pity one can do so little in the time. In town the inclination to walk seems to get less, but if we must live in towns, it is all the more necessary for us to try to keep ourselves physically up to the mark, for to quote Richard Baxter, "A heavy body is but a dull and heavy servant to the mind; yea, a great impediment to the soul in duty, and a great temptation to many sins."

THE STATE REGISTRATION OF TRAINED NURSES.

By Mrs. BEDFORD FENWICK.

IT is with much pleasure that I have responded to the invitation of the Organizing Committee of this Congress to present to you a paper on the State Registration of Trained Nurses. At the present time the whole question of registration is being considered by a Select Committee of the House of Commons, and it is therefore of special importance that the public should be acquainted with the points involved in the demand for this measure.

In order to appreciate the scientific principles which underlie the practice of nursing, a good general education is a necessary preliminary for the special education in nursing, and when we consider the responsible duties required of a nurse when trained, it will be admitted that this training can hardly be too thorough. Matrons and ward sisters, in addition to nursing skill, require powers of organization and of teaching if future

nurses are to be efficiently educated in private nursing, a branch of nursing of great importance, involving responsibilities scarcely fully recognized, and demanding in a high degree resourcefulness and adaptability. In district nursing the nurse, if she is to fulfil her duty, must possess a knowledge of social questions and sanitary matters, and perform preventive as well as restorative work; in our Colonial possessions beyond the seas, nurses frequently have to undertake the care of critical illness far away from any medical assistance; or, again, in connection with our Military and Naval Services, and in Poor Law Nursing it is the cultured woman who is in increasing demand.

It is of the utmost importance to the public, for whose benefit nurses exist, that women of high personal qualities and technical knowledge should be at their service in case of need. What guarantee has the public at present that such are obtainable? Frankly, none. While some hospitals give a prolonged and systematic education, others certify their pupils after a few months' experience, and once a woman is certificated, she may undertake with confidence the nursing of any and every kind of illness, whether she has any knowledge to justify her in doing so or not, and the public has no means of discriminating between valuable and valueless certificates. In civilised countries the State accepts the responsibility of guaranteeing to the community that medical practitioners, and members of other professions (of which the standard of proficiency cannot be judged by the laity) are what they profess to be; thus, the State requires evidence that a candidate has attained a definite amount of knowledge before his name can be placed on the medical register. It is essential that the same principle should be applied to those who practise the art and science of nursing; for, while the public can form its own conclusions as to the personal qualifications of trained nurses, it has no means of ascertaining their professional fitness such as a system of registration would at once supply; thus, primarily, registration if enforced would benefit the public, who at present pay the same fees to nurses of first-rate training and experience, and to women who assume most responsible work, for which they are unfitted both by temperament and by reason of their ignorance. It is at present no uncommon thing to find pupils, who have been discarded by the training-schools after a few months as unsuitable, at work as private nurses in the West End of London, amongst wealthy patients, who are paying high fees in their belief that they have secured thoroughly competent nursing care.

What is therefore needed is the establishment of a standard of education, to which all pupils must attain before being allowed to describe

themselves as trained nurses, or to undertake professional work as such, and, further, that training-schools must show to a recognised authority that they are able to provide the necessary experience and instruction before being allowed to give certificates. But while the hospitals have for long claimed to be something more than mere hospices for the reception of the sick, there is a very strong disinclination on the part of many hospital managers to rate nurses as anything but domestic workers, to provide facilities for their professional education, and to evolve an efficient curriculum.

The cause of this disinclination is, no doubt, ignorance on the part of the majority of hospital managers of the requirements of this special branch of their work. They are, as a rule, men of business, and philanthropists; competent financiers, but unversed in educational methods and requirements. Further, the exclusion of women, with few exceptions, from hospital boards eliminates consideration of the domestic element which is so great a factor in the efficient nursing of the sick.

It is believed by those who have carefully considered the question that nursing education in the future can only be properly systematised by obtaining an Act of Parliament which would provide for the formation of a Central Nursing Council, representative of all the interests involved, which would define and enforce a uniform curriculum of nursing education, which would appoint examiners and confer a recognised qualification in nursing upon those who attain to the required standard of knowledge and efficiency, which would maintain a public register of the nurses so qualified, and would possess the power to remove from that register the name of any nurse who proved herself unworthy of professional trust, thus maintaining the professional discipline which is every year becoming more essential.

A few words are necessary in regard to the question as it affects nurses. What have they to gain? They will gain from the first day that they enter a hospital for training, inasmuch as a standard will of necessity be set to which those hospitals which desire to act as training schools must conform. Thus the pupil will be sure that the hospital she enters has facilities for providing thorough practical and theoretical training; whereas, at the present time, a pupil nurse, after years of hard work, may find that she must begin her training all over again if she wishes to obtain a certificate which carries weight.

And when she has completed her training, it is surely a matter of justice that a nurse should be able to produce evidence, such as a register would at once provide, that she is a skilled worker, and as such should be

differentiated from the amateur, whose services, however useful, cannot be regarded as commanding the same remuneration.

Thus a line of demarcation would at once be drawn between the trained and the untrained, and the skilled and responsible worker would no longer compete in the open market, on an equal footing, with the woman who practises a most responsible profession without taking the trouble to learn her work.

In regard to the medical profession, who rely upon nurses to act in their absence as skilled observers in cases of critical illness and operation, and whose best work may be ruined and consequently their professional reputation affected by carelessness on the part of a nurse, it cannot fail to be an advantage to them to have a public guarantee of a nurse's qualifications.

Whether regarded, therefore, from the point of view of the public, the nurse, or the medical practitioner, the scale weighs down heavily on the side of registration.

In Great Britain, both the General Medical Council and the British Medical Association have passed resolutions in favour of the principle of State registration, and during the last seventeen years various important societies of nurses have adopted its attainment as part of their programme. It was not, however, until 1902 that a society was formed, the sole object of which was "To obtain an Act of Parliament, providing for the legal registration of trained nurses." In the short time which has elapsed since its formation, it has secured a membership of 1,260 trained nurses besides many influential vice-presidents. It has drafted a Bill which has been introduced into the House of Commons, and it has obtained the appointment of the Select Committee which is now enquiring into the expediency of providing for the registration of nurses.

In conclusion, I would ask any of those members of the public who are in the possession of facts which would assist this committee in its deliberations to intimate to its secretary their willingness to give evidence, and thus afford valuable help to a body of women upon whom they themselves rely for assistance in time of need.

THE WORK OF WOMEN AS SANITARY INSPECTORS.

By Miss A. M. DICK.

WOMEN sanitary inspectors are no longer on a first trial. Their work, with its aims and results, is known to most of those who take any interest in the homes of the poor. A great many people, however, seem very much in the dark as to the duties of these health missionaries, and, consequently, as to the real object of their work, and even the necessity for employing them at all.

It is, therefore, desirable that the duties of women sanitary inspectors should be understood, so that their usefulness and difficulties may be appreciated, and that the dwellers in our large towns may realise the amount of work to be done in the houses of the poor, and the necessity for supplementing the meagre staff of women available for doing it.

Women have to pass the same examination that the male inspectors undergo in order to gain a certificate of the same value. Examining boards might well, without reducing the value of the certificate in any way, make the examination for women run more on the lines in which their work lies, including, for instance, the management and proper feeding of infants.

The duties of a woman sanitary inspector sound in themselves simple enough. They consist in enforcing, by advice, by orders, and, where necessary, by serving printed forms, the Public Health laws and by-laws, and the rules of commonsense regulating the cleanliness of houses in every particular, bedding, sanitary conveniences, stairs and passages, ventilation and overcrowding.

Those who are not familiar with poor people's houses, their method of keeping them and the appurtenances thereof, can only imagine the scope of work implied in these few words of definition. Ventilation alone requires never-ending explanation of the benefits and charm of fresh air, and exhortations for personal trials on the part of the one-room householder. Then one cannot approach the subject of windows without referring to the necessity for light as well as air. Most slum-dwellers think nothing

of grimy windows, while many approve of keeping at least one window in their little houses permanently concealed by some sort of blind, and if a pane of glass is broken, both light and air are invariably excluded by a stuffing of rags and paper.

In the way of cleanliness, walls and ceiling are easily tackled, as they cannot be concealed. Some towns give whitewash free, or lend brushes, so that no excuse can be brought forward by householders reluctant to clean. Floors require a great deal of attention, especially if there is much lumber kept in corners or under the beds. To have this removed from its lurking-places, so that the state of the wood-work may be commented on, may take some persuasion on the part of the inspector, who does well to be ever on guard against hurting feelings. Any slop-pails standing about, probably in the press if there is one, have to be denounced by the inspector, and at once removed and cleaned by the lazy housekeeper. Dirty clothes, being stored up for a future washing-day, are routed out from unsuitable corners. Bedding, if necessary, is examined and orders and advice about its cleansing or disinfection are issued.

How to get rid of vermin is a frequent subject of discussion between inspector and tenants. Some are anxious to follow instructions for extermination, while others of less refined feelings are very indifferent on the subject.

Besides the house and its belongings, the stairs, passages, and back court of the "land" require inspection. This cleaning is performed by the tenants in rotation according to by-law. Many minutes of the inspector's day are taken up in seeking out the tenants whose week it is, serving notices on defaulters, and explaining the law on the matter. If a house appears too small for the number of inmates, a measuring tape is produced, and the cubic space reckoned. The details of the family's income and the children's ages are taken down for future reference, and if doubts arise as to the reliability of the information thus supplied, the neighbours are generally ready to disclose the real number of the family, or the fact of lodgers being kept.

Overcrowded houses are, of course, revisited, and prosecution may follow if the overcrowding does not cease within a reasonable time. Structural defects, such as damaged roofs, rhones, trap gratings, sinks, windows that are not made to open, &c., are noted and reported to the male inspector for the district. Visits to infectious cases may form part of the woman inspector's duties, in order to impress on the householders the possibility of preventing disease spreading, and to see that they are carrying out the proper measures as far as possible. Where there is a

consumptive patient the visits of the inspector can be of real service to the family, though they are unfortunately often slow to appreciate compulsory fresh air treatment, and impatient of the precautions considered necessary.

Workshops where women are employed and houses where work is done at home may also have to be visited by the woman inspector. The former are reported on regarding the number of workers found employed, the means of ventilation, and the condition of cleanliness.

The outworkers require more particular inspection, and besides those classified there are many home-workers to whom the inspector's visit is very necessary. Hawkers, for instance, who make their own confections for the barrow, often lay their sweet-stuff to harden all over the room where unwashed children are sprawling, and those who deal in "small-wares" or do a little humble dressmaking are apt to keep their goods in homely but unsavoury seclusion in the box-bed. Explanation, appeals to pride or common-sense, may be of more avail in such cases than a peremptory manner. Inspectors have to learn something of being "all things to all men," and apply varieties of treatment on as many different occasions, especially in cases where they have no actual legal power, such as with regard to the cleansing of dirty children.

In fact, legal powers are not accorded to the sanitary authorities as might be expected considering the nature of their work. Even the right of entry into dirty houses is not assured them, a magistrate's warrant being required if a householder objects to admitting the inspector to view his premises.

Verminous persons cannot be dealt with legally unless they apply to to be cleansed.

The London County Council has framed a Bill which may confer considerable gain in this direction, though the process involved is a very roundabout one. The medical officer will have power to enter a house suspected of being infested with vermin, and on his certificate the sanitary authority may give notice to the occupier to have it cleansed. This would apparently include persons and clothing, but what is wanted is more direct legal facility for dealing with such cases, in which delay is the last thing to be tolerated.

The position of an inspector entering houses for this purpose is always a difficult one, sometimes disagreeable, and, it may be, even dangerous. Complaints from head-masters about certain children are sometimes received at the office and a visit of investigation follows, which requires great tact on the part of the inspector in smoothing the probably roused

feelings of the parent, who would only be standing on his rights if he refused to let his children be examined at all. Cases of parental neglect to sufficiently feed and clothe their children can be notified to the Cruelty to Children Inspector, who then visits the family and exerts his influence for recalling parents to their duties.

Occasionally factory or laundry workers complain in their homes to the inspector about insanitary conditions where they work, and when they make application for remedy in this indirect way and are willing to assist with details of evidence, it devolves on the inspector to forward such statements to headquarters.

Coming into such close contact with these poor households the inspector cannot fail to note the health of the people, and especially that of the children. All medical men are agreed that the cause of such a large percentage of deaths in infancy is mostly due to mistaken feeding and unsuitable surroundings. It is a common experience to find infants of a month or two old sucking a piece of gristle or a ham bone, or being fed on "saps," a mess of bread or biscuit soaked in milk, and on further inquiry it is found that the baby's sustenance also includes the run of the table.

Here the mother must be argued with and instructed as to an infant's digestion and requirements in the way of food. The babies' bottles and clothes are examined, as well as their own little persons, where it seems necessary, which means in most poor houses; and the how and why of keeping these clean are impressed on those in charge.

Occasionally the inspector can recommend a child for a fresh air home, which is a much appreciated benefit and a splendidly practical way of raising both moral and physical tone.

A large amount of sympathy for every imaginable ailment must be always on hand, as well as practical advice to some sort of first aid treatment if possible. Cut feet, sore eyes, toothache, sore throat, bilious attacks, skin eruptions, are all submitted to advice or inspection with pathetic eagerness. Not that the sanitary staff lay claim to any medical attainments, but directions as to ordinary home treatment are within the scope of most, and always give opportunities for renewed lectures on the need of absolute cleanliness of person and clothes as an aid to recovery, and as a preventive measure. A visit to the dispensary can often be induced by a promise of calling again soon to see how the sufferer progresses and what medicine the doctor gave. These are not hard tasks, but they help to make the people realise that sanitary inspection as a whole, as well as in detail, is undertaken for their ultimate benefit.

The confidence placed in the powers of the woman inspector by our

humbler fellow citizens is, in many instances, embarrassingly wide in its scope. Besides complaining about their neighbours' pigeons, cats, or noisy children, they may want an old granny coaxed into the poor-house, or advice on emigration given to a son. They constantly ask about admission to convalescent homes, and frequently regard the "sanitar" as a likely bureau for supplying customers for a day's washing or cleaning.

Where a woman inspector's duties end it is hard to say, for her usefulness must necessarily exceed the definition of her work given at the beginning of this paper. She cannot deliberately pass the many opportunities for a word in season for moral as well as physical welfare. Attendance at a Girls' Club, if such is available, may be urged for some girl just emancipated from school who is apt to "run on the street;" amusements may be suggested for a sick child; practical suggestions about children's clothing may be given to the harassed mother of "a squad o' weans;" the penny savings bank may be advocated. All such helpful hints, even if merely given casually, will be remembered, and though, perhaps, not acted on they will be talked about. The lives of the very poor are so devoid of healthy interest that the inspector's visits and remarks form a subject of conversation, and lead to comparisons and discussion, so that the metaphor of the ripples made by a stone cast into the water will be applicable to their spreading influence. A few words of counsel on subjects like those just mentioned do not take up much time, and may guide ignorance on lines more approaching wisdom than it could have arrived at unaided.

In this way the usefulness of a woman sanitary inspector is not all directly practical, but exercises the abstract power of influence. The mere fact of knowing that there is such a woman at large in the district must have a salutary effect on some, at least, of the slovenly housekeepers. Praise, advice, sympathy, and even admonitions, severe strictures and threats, when tactfully administered, are a spur to the lazy, careless, and indifferent, and a possible means of raising the degraded. Constant revisiting is the only key to improvement in ill-kept houses. This is very difficult, in fact impossible to accomplish, if the inspector has a very large area for working in. Spasmodic cleaning can be enforced, but not even prosecution can induce cleanliness as a permanent habit. Personal interest and influence, backed, of course, by the power to deal summmarily with the incorrigible, is the most potent factor at present for purifying slums. It is not possible for the inspector to keep in touch with individual households if her district contains a few thousands for visitation.

In Glasgow there are six women inspectors; in Dundee there are two;

Paisley, Leith, Aberdeen, Greenock, and Belfast each have one, and at the time of writing Edinburgh is about to appoint two. Manchester has about twenty women health visitors whose work is on lines very similar to that of sanitary inspectors, and Birmingham and some other English towns, as well as various London districts, are also supplied with them.

Before the work can reach its full efficiency there must be more women employed in all our large centres. Not only can their object be to alleviate present unhealthy conditions and consequent degradation and distress, caused through ignorance or culpable neglect, but by dint of steady vigilance and practical advice, so to educate the people that some day, at no very remote period, they may find that house-to-house sanitary inspection is no longer required.

THE WOMAN'S PART IN THE CAUSE ND PREVENTION OF PULMONARY TUBERCULOSIS.

By Miss BLANCHE GARDINER, B.A.Lond.
(Associate.)

THE King, when founding the King Edward VII. Sanatorium last November, while regretting that it was impossible for the Queen to accompany him, said, "Like myself, she is deeply interested in the fight against Tuberculosis;" and just as the Queen-woman from her throne, so also, every other woman by her action in the home, can interest herself in consumption, and lessen the disease.

We might divide the causes of consumption into two main groups:—

I. *Active Cause*, i.e., the tubercle bacillus, found in the sputum, tubercular lesions, etc.

II. *The Predisposing Causes* direct heredity of seed, and indirect heredity of soil.

The first, that is direct transmission of the tubercle bacillus from parent to child, actually before birth, is so rare and exceptional, as to be almost a negligible quantity.

But as to the second, the indirect heredity of soil, *i.e.*, a hereditary predisposition towards tuberculosis, as Prof. Bouchard puts it: "What parents transmit to their children is *potential*, not *actual*, tuberculosis." Further, too, "Tuberculosis is the result, and the evidence of degeneracy

of the system. The bad state of health of the parents leads to this organic degeneracy in the children, and all degenerates are disposed to the disease." And again, "The most powerful predisposing cause is found in neurotic heredity; the parents of the children who succumb to tubercular meningitis are neurasthenic and hysteric subjects, epileptic, insane, or intemperate."

Under the heading *Environment*, we come to the more undisputed and, at the same time, the more important and predisposing causes, viz :—

1. *Lack of Air, of Sunshine, of Cleanliness*, occurring most where the population is densest, and where the ignorance of the public on matters of hygiene is greatest.

2. *Overstrain*, i.e., *physical* overstrain, due to too much work, or too much play; and also *intellectual and moral* overstrain, "the product of the constant struggle for existence, the cares of ambition, the passions, the sorrows of life . . . . and also the multiplication of emotions by sensational books, theatres, gambling, and the undue excitements of town life."

3. *Privation and Misery*, comprising poor, insufficient and improper food and clothing, and small and insanitary dwellings. These, too, are closely associated with, and may lead to a fourth predisposing cause of tuberculosis :—

4. *Alcoholism.*

5. *Certain trades and occupations* which favour the development of the disease, viz., those worked under particularly unhygienic conditions, where the workers are exposed to certain irritant dusts (file-cutters', etc.), and those where the workers in hand-laundries, or as charwomen, may be especially subjected to contagion from the dried tubercular sputum.

6. *Certain antecedent diseases* (also local injuries), which predispose to consumption, *e.g.*, bronchitis, measles, whooping cough, and especially influenza. And lastly, as a most necessary environment for the production of tuberculosis, we get—

7. *Contagion* (a) *from man to man*, through the sputum, tubercular dust; (b) *from animal to man* (pace Koch); through diseased milk, meat, etc.

What can *we women* do to obviate the predisposing causes of consumption?

Of course, the broad lines of action are :—

1. ***Destroy the active cause, the tubercle bacillus.***

2. ***Remove all the predisposing causes.***

I. *As wife and mother.*

In Dr. Cowie's article, dealing with the occupational incidence of phthisis, it is shown that "while in *males* the highest death rate is recorded in the age period 45–65, yet in *females* the age period 25–45 is the most severely affected; and the reason for this higher rate amongst females is that the age group 25–45 is the one chiefly associated with pregnancy and child-bearing, at which times females are specially liable to be attacked."

It is very common history, he says, to find that the onset of phthisis dated from a confinement or miscarriage, and the evidence of different authorities shows that phthisis not only frequently originates during pregnancy, but that when previously existing it is aggravated by this state.

Again, "nursing" is a further cause of exhaustion to the consumptive mother, not to speak of the danger of contagion to which it exposes the child.

For the female especially, marriage should be definitely discouraged, and Professor Peter tersely formulates the rule: "maid, no marriage; wife, no children; mother, no nursing."

"For tubercular females, who have been 'cured,' and have been well for five or six years, marriage is permissible, provided that they have enough resources not to have to work too hard, and when married are able to lead the same hygienic careful, rational life they led before marriage," and that their children are able to be especially well nourished, and made to live an open-air life, and follow, if possible, an out-door occupation.

Yet the mother, if by chance she *is* consumptive (and yet cannot send the children away from her, and give them the best hygienic environment), still can do so much to lessen the risk of infecting them, by care in the little details of life, *e.g.*, she can refrain from kissing the little ones on the mouth, even if she may have the grief of hearing them say, as I once heard a little seven-year old boy say to his consumptive mother, "You do not love me, as you used to; you never kiss me now." Again, she can be careful, not to feed the children with a spoon, which she may have previously put into her own mouth just to see if the food were right; nor to drink out of the same cup; nor taste the milk in the bottle through the nipple (to see if it is too hot or sweet enough), and then straightway put it into the baby's mouth.

And again, too, since we know that certain diseases predispose to, or lessen the resistance against consumption (viz., influenza and alcoholism in the adult; and whooping cough and measles in the child), therefore is it

not the mother's part to do all in her power to lessen infection rather than to disregard it, or even run into the way of it, so that all the children may get the measles or whooping cough at once, and "have it over and have done with it"?

And cannot the mother by refraining from the generally unnecessary alcoholic drink herself, by her action and example discourage the liking for it in her children?

II. *As the manager of the home.*

What a wealth of work there is for her here, and to what a great extent she may either cause or lessen consumption! We have seen that lack of fresh air, of sunshine, of cleanliness, of proper food and clothing; and overcrowding (in the bed-room, sitting-room, etc.) are all important in the causation of consumption, and is it not perfectly evident that every one of these items lies well within the woman's province, and that it is in her power to remove them?

Whoever heard of a *man* drawing down the blinds, and thus shutting out the sunlight for fear that the curtains or carpets should fade? Or of a man, who closed the windows not because of the draught, but lest the window curtains would get dirty—or the dust would come in—or the brasses and silver would tarnish?

It is the *woman*, too, who so zealously guards for visitors and Sundays that best drawing-room or front sitting-room, and so causes overcrowding in the other living-rooms; and who will for months keep empty a good spare room for that very occasional visitor, whilst perhaps, meanwhile, several of the children are relegated to an overcrowded attic bed-room, or the poor servant (no uncommon thing, especially in Scotland) to a bed in the kitchen or press.

It is the woman, too, who has the choosing and cooking of the *food* (and food which is inadequate in purity, quality and quantity may be a most powerful factor in producing Tuberculosis); and who sorts the clothes for the wash, and who, perhaps carelessly without taking any precautions, sends out the handkerchiefs and other linen of phthisical patients, and thus may have laid to her charge the large number of deaths from consumption amongst those engaged in laundry work and washing.

It is *women*, too, who let lodgings at often miscalled "health-resorts," and who are deserving of the highest blame, if they let to others their rooms, previously occupied by a consumptive patient, without having them disinfected, and the curtains and hangings and furniture thoroughly cleaned.

III. *As Teacher.*

When we think of the number of *women*-teachers there are in the world, women teachers in elementary schools, in secondary schools, in colleges, in Sunday-schools, in charitable institutions, what a power they might be in the lessening of consumption, if only they had themselves sufficient knowledge to teach and put into actual everyday practice even the elements of the prevention of this disease; if they could tell every child to breathe through the nose (and have those who could not do so medically examined); if they would accustom their pupils to have their school-room windows open, not only *between* classes, but *during* classes, so that they need not all spend, say five hours a day, working in "an atmosphere which produces headache, lassitude, anæmia, and chronic ill-health, and thus predisposes them to consumption, and causes them to succumb to the attacks of the tubercle bacillus."

IV. *As Nurse.*

It is not only as the trained *professional* nurse at the many existing consumption-hospitals and sanatoria, that the woman-nurse has a definite work in the treatment of the disease, but think also of the number of *amateur* nurses—the wife, the sister, the mother, who at any time may suddenly be called upon to tend a husband, or brother, or child, laid low with consumption.

And in the later stages, especially, it is the woman, the nurse (and not the patient), who is responsible for seeing to the immediate and total destruction of the tubercle-bacillus, by burning the sputum, and the rags used for handkerchiefs, and by submitting to boiling heat the invalid's spoon, knife, fork, etc., and by thoroughly cleaning and having disinfected the room occupied during life, and vacated after death.

V. *As Sanitary Inspector and Health Visitor.*

Perhaps here (viz., in visiting the cases of consumption voluntarily, or as in Sheffield, compulsorily, notified) more than in any other direction does the need for a woman's tact (*i.e.*, touch) come in. For it is a difficult and delicate work she has to perform, that of visiting the home of an invalid, who has been, and may continue to be, ill for many months with consumption; to try to persuade him to alter his ways, and to get the relatives too to alter their fixed ways, as regards closed windows, carelessness with the sputum, etc.; and also at the same time to act in unison with the medical man, without in any way hurting anyone's susceptibilities.

Surely this is more the work of a woman than that of a male inspector;

for a woman can get access more easily to the consumptive patient's bedside to give him, or her, the necessary advice; and again, in a time of trouble and illness, and finally death, a woman's presence will be more easily tolerated than a man's about the house, when she has to give the directions about disinfection, and to make the delicate suggestions about burning the letters, papers, etc., and even perhaps the written dying message of the loved one so lately dead.

Thus women sanitary inspectors, and fully trained health-visitors, are engaged to visit the notified cases of consumption in many large English towns (Liverpool, Manchester, Leicester, etc.); but in Glasgow, though there are six women inspectors on the sanitary staff, Dr. Chalmers says their work has no especial bearing on this disease.

There are yet many other channels that must suggest themselves to us, in which women can help to prevent the spread of consumption; but it may be hoped that the few different ones touched upon may have awakened us to the fact that we, as *Women*, have it in our power to play a most important part in lessening this fell disease.

DISTRICT NURSING AS A HYGIENIC AGENCY.

By Miss GUTHRIE WRIGHT,

Hon. Secretary of Queen Victoria's Jubilee Institute for Nurses (Scottish Branch).

I TAKE as my text for this short paper Mr. Charles Booth's sentence in "Life and Labour of the People of London": "Of all forms that charity takes, there is hardly one that is so directly successful as district nursing. It is almost true that wherever a nurse enters the standard of life is raised."

1st. The primary and most evident way in which the standard is raised is the *restoration to health* brought about by the district nurse in her faithfully fulfilling her duty "to nurse under the doctors' directions in the homes of the sick poor." On this subject it is best to quote from the

letter of a doctor: "A great deal more depends in medical practice upon careful nursing and dieting than on the drugs we prescribe. This is specially true in dispensary practice, for our patients are very ignorant, often very careless. Often have I gone away from a patient with a sick heart, because I knew that the most carefully-given directions would be disregarded; but when a competent nurse will come and do what is required, I go away with a sense of relief and without anxiety, knowing that the instructions will be carried out faithfully and efficiently. And I may add, though perhaps it goes without saying, that I have found the nurses always anxious to co-operate heartily with the doctors and carry out their instructions. They have also been a great boon to the patients, and that not only from a professional point of view, in washing, dressing, and nursing patients, but from a more general point of view. We hear in our day much of the cry of the outcast poor, and innumerable organisations are being started to relieve want and poverty; but when all has been said, the most powerful factor is personal influence, and the kind, cheery way, never worried, never wearied, with which the nurses have gone in and out among the poor has elicited many a heartfelt note of gratitude. They have brought cheer and joy to many homes; and as they have restored health to the sick bodies, they have restored life to the drooping hearts. I earnestly hope, therefore, that the Nurses' Institute will receive liberal support, and that you will be able not only to double but to quadruple the number of your nurses."

2nd. Valuable as district-nurses are, working under and with medical men, it is a question if their still greater influence in raising the standard of life will not be found to be as *teaching* and *preventive agents.* To promote a more general knowledge and practice of the law of health is the chief object of this Congress, and one in which, so far as the poor and working classes are concerned, no more efficient co-workers could be found than the steadily increasing body of district nurses, who have constant opportunities, by precept and practice, of explaining and pressing home the laws of health, is great as well as in small matters. Not only is the district nurse well fitted for this duty because of the special and excellent training she receives, but because in many cases she, in the course of her duty, comes into close contact with the best possible methods of domestic management. It is astonishing how perfect is the ruling of her house by many a working-man's wife. From such good wives Nurse learns what is possible in similar households, and by tactful hints and encouraging words she may and does produce marked improvement, which must make for the better health of whole families. Much tact and kindliness are needed,

especially until the patients and their families realise that Nurse is their friend, and in sympathy with their difficulties. In trying to raise the standard of life, the following are a few of the points the Nurse may deal with :—

(*a*) *Household Sanitation.*—Nurse will explain and support sanitary regulations, bring people to see that the sanitary inspector is a true friend and not an interfering enemy from whom things must be hidden, and Nurse can instruct them how to take advantage of what sanitary authorities are able to do for them in regard to drainage, disinfection, and nuisances. Then she can explain why fresh air is necessary, not only for the sick, but in order to retain health; why chimneys must not be stuffed up, nor gas burned at night, nor cisterns allowed to remain dirty, and she can advise as to the management of the dust bin, etc. She can also give valuable hints as to the selection of a house, and tell what requirements are essential and what are at least desirable.

(*b*). In cases of *incipient consumption* Nurse notes when attending one patient that another member of the family is drooping, and much can be done for the patient at an early stage if the importance is understood, not only of open windows but of sitting out of doors in the sunshine if possible; of using the perhaps more sunny parlour, instead of reserving it for special occasions; of special care as to clothing and avoidance of chills, etc.; and Nurse can obtain from other agencies the nourishing milk and eggs for the poorer patients. In these ways much may be done to combat this terrible disease in its earlier stages.

(*c*). In *infectious illnesses* Nurse can show, by precept and example, how to prevent their spread; in consumption, by the use of a separate room, even at the risk of some overcrowding to the rest of the family, by disinfection of sputum and so on; to prevent smallpox she can explain the facts and give the figures in favour of vaccination; she can advise in which illnesses to prevent contact and how to do it, in which promptly to seek for the causes; she can tell of the importance of getting milk from a clean and well-kept dairy, and of scalding it when got, and keeping it covered. There is, in short, no end to the preventive teaching she may give on these lines. In the remote parts of Scotland and Ireland much superstitious terror of infection exists, and it will lie with trained and intelligent nurses to help to remove this.

(*d*). For *the mother after confinement*, the patient herself and the neighbour who helps with the housework realise what stress Nurse lays on the necessity of the mother having a long enough rest, the bad

economy of making a too early effort to get up and work, also the necessity of her having as good food as the family resources can allow. Attention to these points lead to earlier and more permanent health, a matter of infinite importance not only to the mother herself but to her family.

(*e*). For the *new-born infant* Nurse accentuates the importance of attention to the eyes (a great percentage of blindness is traceable to early neglect) and to the right kind, amount, and times of feeding; and she explains and enforces that the infant must not have a share of whatever is going, including whiskey. She can also give useful hints on clothing, and in a small, perhaps overcrowded house, she should advise that the infant should sleep in a cot, made say of a box or basket, and not on the mother's arm, which entails risk of overlaying. Under this heading alone district nurses should gradually do much to decrease infant mortality.

(*f*). For *young children* Nurse can explain also why the overcrowding at night is so bad, predisposing children to rickets and other ailments, and that with two rooms all should not sleep in one. She can, by explaining in simple language the nature and uses of the skin, and how choked pores throw more work on the lungs, kidneys, etc., show that the usual weekly bath is not enough for children; she can give good reasons for advising high dresses and long sleeves, care of the teeth, etc.

(*g*). Nurse has many an opportunity of *teaching* and *improving cooking*, not only for the sick, but for the other members of the family. Perhaps no ailment is so universal and so preventable among the poor as indigestion in its many forms, and the number of puny, ill-fed children is an evidence of poor food and bad cooking. A good work is indeed done if the mothers are made to understand what a terrible enemy to nerves and digestion is badly-prepared tea. Nurse can show that good cooking is not only cheaper than bad cooking, but also aids nutrition and is pleasant. "To preach porridge and the pulses," as the late Sir Robert Christison exhorted, to show how to prepare a few well-cooked, wholesome, and varied dishes, including broth and pea soup, to prove that a child's craving for sweets is better satisfied by a wholesome suet dumpling with treacle than by the bad sweets and pastry so many pennies are wasted upon, surely these are lessons on which the district nurse may well expend a little time, as their result is effectively to raise the standard of life.

I have only slightly illustrated the innumerable ways in which a district nurse can raise the standard of life in the families among whom she works. The knowledge of all these matters, and how to teach them, does not come to the nurse herself by intuition. Queen's Nurses, the

district nurses with whom I have the honour to be connected, have a long and arduous training, not only the usual hospital course in which they learn how to nurse, but during training in the district home they learn monthly nursing, gynæcology, and dieting of fevers, hygiene, cookery, and, best of all, they learn under the superintendent and the district superintendent the daily lesson of how to apply and make good use of all the knowledge, theoretical and practical, which they have gained. They learn to look at things from more than one point of view; good air and proper food, the essentials of health, are not always to be found, and there is no use of talking of what ought to be, if it cannot be. The nurse must try to improve what is there, and to explain in simple popular language the "reasons-why" of things. Above all, each nurse learns that there is need for infinite tact and patience,—it must be line upon line, precept upon precept, but she has her reward. It is difficult to overestimate the influence for good of the district nurse, going in and out among the people day by day, and year by year. The steadily increasing army of blue-robed Queen's Nurses wage a never-ceasing war against disease and suffering. In time, with adequate money forthcoming, there will surely be such a health-missionary in every parish throughout Great Britain and Ireland.

HOW WOMEN AS COUNCILLORS MAY IMPROVE SANITATION & HOUSING IN RURAL DISTRICTS.

By Miss CONSTANCE COCHRANE.
(MEMBER.)

ABSTRACT.

MISS CONSTANCE COCHRANE touched on the good work which had been done in towns by woman guardians, whose services were increasingly appreciated, and regretted that in most rural districts the care of the young, the aged, and the infirm was still in the hands of men only, and of the ordinary workhouse officials.

There were some 1,000 woman guardians altogether, but of these only about 110 were also rural district councillors. Men and women, with their distinct gifts and capabilities, were equally needed on rural district councils, and women should not devote their attention exclusively to guardian's work.

Educated women with leisure, and living in the country, would naturally be conversant with the needs of the cottagers, as to water and milk supplies, housing, sanitation, etc., and would be able to furnish their councils with accurate information and suggestions, as the result of their observations in visiting the homes of the poor. Women were specially fitted to observe and deal with the details of the various matters affecting the surroundings and the health of the women and children, which important considerations were at the present time constantly overlooked.

The members of rural district councils were busy men (the majority of them farmers), as a rule quite unfamiliar with the homes of the people, and ignorant on questions of health and sanitation.

With regard to milk supplies, woman councillors could do invaluable work in trying to impress upon their fellow councillors the importance of more care and cleanliness in the dairy, and the evil effects on the health of the children of drinking impure milk.

Medical officers of health would find in woman councillors their warmest supporters and assistants.

Several instances of jobbery and corruption on the part of rural district councils were given from the experience of the newly-formed Rural Housing and Sanitation Association, and the writer considered that in this respect women would be less tempted than men, owing to their more independent position, and inherently smaller respect for vested interests, especially such as injured others.

It was much to be regretted that so few women offered themselves for election on rural district councils, but this was explained by the natural repugnance amongst many of them to serve on bodies consisting of men only, and discussing openly all kinds of painful subjects. Also, the standard by which women were at present judged was a very severe one.

For all these difficulties there was but one remedy—that more women should come forward for the work. Single women, daughters and sisters of professional and other men, and married women whose children were grown up, should feel it their duty to devote part of their time to the promotion, in the public service, of the welfare of the most helpless classes—the women and children living around them.

Woman councillors and their friends should be loyal to their own sex, not by making comparisons adverse to men, but by generously recognising the good work done by women.

True modesty, combined with courage, ability, and devotion to duty, would win adherents in a way that no amount of self-assertion would ever do, and would command respect from all men and women whose good opinions were of real value.

CONGRESS AT GLASGOW.

CONFERENCE ON THE HYGIENE OF SCHOOL LIFE.

ON THE RECORDING OF OBSERVATIONS ON PHYSICAL CONDITIONS IN SCHOOLS.

By E. W. BRABROOK, C.B., F.S.A.

AMONG the measures to be taken to promote and develop healthy conditions of school life, that of recording and comparing information relating to the physical condition of the pupils (why not also of the teachers?) is of great importance, though only of indirect effect. It is not without its special difficulties:—What are the observations most important to be made? what is the best method of making them? how can they be made useful for purposes of comparison? what are the safe inferences to be drawn from them? and above all, how is the hard-worked teacher to acquire the competence and find the time to carry out this special work, in combination with the other unceasing demands upon him? are questions that at once occur to the mind. So important are these questions considered that they have engaged the attention of not fewer than five Committees of the British Association for the Advancement of Science; and I shall ask leave in this paper, instead of offering any original observations of my own, briefly to state what has been the result of the deliberations of these Committees.

First in the order of time was the Anthropometric Committee, which was appointed at Bristol in 1875, having the late Dr. Farr for Chairman, and Mr. Francis Galton for Secretary. We continued our labours until 1883, when (Mr. Galton being Chairman) we presented our final report, drawn up by the late Sir Rawson Rawson and the late Mr. C. Roberts. A

Note.—The Proceedings of this Conference commenced with an Address by Prof. John Edgar, M.A. See page 341.

large portion of the report related to observations on adults, which I pass over. The statistics collected with reference to children showed the influence of age, sex, nurture, occupation, and sanitary surroundings on the physical development of the population. All classes were represented, from the children of the upper and professional classes at public schools, like Eton, Marlborough, and Radley, to those of the poorest town population in public elementary or Board schools, charitable institutions, and industrial schools. The most obvious fact which the figures disclosed was the diminution in stature which attends the lowering of the social scale, a difference of five inches existing between the average stature of the best and worst nurtured classes of children of corresponding ages.

The test age adopted was that of school children of the age of from eleven to twelve years. This age was selected as peculiarly suited to the study of the media, or conditions of life, which influence the development of the human body, and as being subject to all the wide and more powerful agencies which surround and divide class from class, but yet free from the disturbing elements of puberty and the numerous minor modifying influences, such as occupation, personal habits, etc., which in a measure shape the physique of older boys and adults. The mean height of boys of this age in the public schools, which were situated in the country, was 55 inches; in the upper middle class schools in towns, 54 inches; in the lower middle class schools in towns, 53½ inches; in elementary schools among the agricultural labourers in the country, 53 inches; in those among the artizans in towns, 52½ inches; in those among the factories and workshops in country places 52, and in towns 51½ inches; in military asylums, 51 inches; in industrial schools, 50 inches.

This exceedingly smooth and regular gradation is due to the combination of causes arising from social conditions, including the influences of leisure, mental and manual labour; from nurture, the influences of food, clothing, nursing, domestic surroundings, etc.; from occupation, the influences of external physical conditions, exercise, etc.; and from climatic and sanitary surroundings.

This observation was followed by one on the rate of growth in the several classes. Those classes are distributed among the whole population in the following proportions:—

Class 1.	Upper and professional classes,		4½	per cent.
„ 2.	Commercial classes ...	...	10	„
„ 3.	Labouring classes ..	...	47½	„
„ 4.	Town artisans ...	...	27	„
„ 5.	Lower town population	...	11	„

The growth in stature observed between the ages of 10 and 17 was :—

In Class 1	... ...	14 inches.
,, 2	... ...	14½ ,,
,, 3	... ...	15 ,,
,, 4	... ...	14 ,,
In the general population	... ...	14½ ,,

The increase in weight during the same seven years was :—

In Class 1	... ...	68 lbs.
,, 2	... ...	63½ ,,
,, 3	... ...	64½ ,,
,, 4	... ...	57½ ,,
In the general population	... ...	63½ ,,

Other observations taken were those of chest-girth and strength, and here the classes were not discriminated. The mean chest-girth observed for each age, with the number of observations, was—

Age 10	and not	11	... 222	observations	...	26 in.
11	,,	12	... 379	,,	...	26½ ,,
12	,,	13	... 458	,,	...	27 ,,
13	,,	14	... 596	,,	...	27½ ,,
14	,,	15	... 894	,,	...	28½ ,,
15	,,	16	... 1725	,,	...	29½ ,,
16	,,	17	... 1280	,,	...	31½ ,,
17	,,	18	... 2073	,,	...	33½ ,,

Strength of arm was estimated by means of a spring balance. The stronger arm was used to draw, and the other, extended straight from the side as nearly as possible in the line of the shoulder, to resist. The hand of the drawing arm was brought back towards the ear as an archer uses a bow, and the number of pounds indicated on the dial was recorded as the drawing strength. The following mean results were obtained :—

Age 12	and not	13	... 49	observations	...	37½ lbs.
13	,,	14	... 119	,,	...	40 ,,
14	,,	15	... 375	,,	...	42½ ,,
15	,,	16	... 531	,,	...	47½ ,,
16	,,	17	... 438	,,	...	55 ,,
17	,,	18	... 388	,,	...	62½ ,,

It will be observed that the increase during the school age is very rapid.

The conclusions drawn by Mr. Roberts were :—

1. After the age of 10 years the greatest increase in stature takes place at 13 and 14; in chest-growth at 16 and 17; in weight at 15, 16, and 17; and in strength at 15, 16, 17, and 18 years. The chest-girths and the strength have a more direct relation to the weight than to the stature.

2. Stature increases rapidly to the age of 21.

3. Weight increases rapidly to the age of 19.

4. Chest-girth increases at a rate similar to that of the weight.

5. Strength increases rapidly and at a rate similar to that of the weight up to the age of 19.

Other observations taken by the Committee related to colour of eyes and hair, complexion, breathing capacity, height, and span of arms. Complete returns were obtained from some schools on all these points; but with regard to breathing capacity and sight, the number of complete returns was not sufficient to give trustworthy statistical results. On these points a difficulty arises in comparing the returns of different observers from the greater or less skill and accuracy with which they have been trained to make the observations, or in other words from the personal equation which is so great an element in all similar work.

Though the final report of the Anthropometric Committee had been made in 1883, some minor matters required attention, and a small Committee was appointed to wind the business up. We appended to our report a contribution on eyesight, by Mr. Roberts. To ascertain the influence of school-life on the eyesight of boys, about 3,000 observations were made at Marlborough College by the Rev. S. A. Preston with Snellen's types, by means of a handy book prepared by Mr. Roberts. The average distance at which No. 1 type was read increased at an almost uniform rate of 1 inch for every 2 years up to 18 years of age. The younger masters, between 20 and 40 years of age, read both types at a greater average distance than the boys. Judging by the No. 1 test, 8 per cent. of the boys had imperfect near sight, *i.e.*, could not read the type at a greater distance than 12 inches, 86½ per cent. had good near sight, *i.e.*, could read at a distance of from 12 to 26 inches, and 5½ per cent. could read at from 26 to 32 inches. Judging by the No. 10 test, 16½ per cent. could not read at a greater distance than 6 feet, and were, therefore, short-sighted; 74½ per cent. could read at from 7 to 13 feet and may, therefore, be classified as having good far sight; and 9 per cent. at from 14 to 18 feet, having long sight. 60 per cent. of the boys were found to be more or less astigmatic, 28½ per cent. horizontally, and 31½ per cent. vertically. There was a tendency for this defect to increase with age. 2½ per cent. of the

boys were found to be colour blind. Such observations as these are not only of great value to science in the aggregate, but of benefit to the boys themselves by giving them information as to the condition of their eyesight.

The second of the five Committees was appointed at Edinburgh in 1892, having the late Sir Douglas Galton for Chairman and Dr. F. Warner for Secretary. Its object was to investigate the physical deviations from the normal among children in elementary and other schools. Its reports showed that, while general education had effected excellent results, much remained to be improved concerning the care of the mental and physical conditions of children, especially as to conditions of unevolved brain power, which would be remediable by better classification and training in certain cases. It recommended that teachers should be specially trained to undertake the educational care of weak and mentally feeble children. The children in a large number of elementary schools were examined, and 19 per cent. of the boys and 16 per cent. of the girls were found to show some defect. Upon analysing the observations in detail, it appeared that the proportion of dull children was lowest in schools where the physical training was best. Something over one per cent. of the children were so afflicted with mental or physical disorders as to require special care and training, being unfitted for the public education provided in ordinary elementary day-schools.

The Committee suggested the need of management and care in training stage by stage, with the object of improving each phase of mental ability and removing individual disabilities. Children with any degree of congenital defect in development usually require medical care as to conditions of the ears, throat, and mouth, also as to eyesight and in general health culture. Abnormal nerve signs may often be removed one by one in the daily practice of physical exercises and adapted training, thus rendering the brain more apt for mental instruction and teaching. Sanitation and the practical application of hygienic principles to school life may lessen the frequency of developmental defects and the proportion of mental and physical weakness and mortality co-attendant. The credit of the investigations and reports of this Committee is entirely due to Dr. Francis Warner.

The third Committee, which was on anthropometric work in schools, was appointed at Nottingham in 1893, and had Professor Cleland for Chairman, and Professor Bertram Windle for Secretary. From returns of 398 schools, it was ascertained that measurements were taken in 58. Of these 11 (out of 89) were girls' schools. A circular of suggestions for carrying out anthropometric observations in schools was prepared. Considerable interest was by this means awakened in the minds of teachers. Professor

Alexander Macalister afterwards became Chairman of this Committee. The suggestions which it issued qualified as essential observations those of height, weight, chest-girth (applicable to boys only), vision, both as to acuteness and as to distinction of colours, and hearing. Other valuable, but not essential, observations are size of hand, span of arms, length of trunk. The directions as to test of vision were approved by Mr. Priestley Smith. They prescribed the use of Snellen's test letters for acuteness, and that the vision of each eye should be recorded separately in the form of a fraction of the normal. For colour vision, Holmgren's wools were recommended. In these respects, the suggestions were the same as those of the former Anthropometric Committee. The directions as to tests of hearing were approved by Mr. Frank Marsh. These are two—the voice test and the watch test. The first determines the greatest distance at which an ordinary conversational voice can be heard by each ear and the words repeated; the second, the greatest distance at which the tick of a watch can be heard by each ear, the eyes being closed in both cases.

The fourth Committee was appointed at Glasgow in 1901, and was for the purpose of organising a pigmentation survey of the school children of Scotland. By the help of the Royal Society, the Scottish Ethnographic Committee, and the Educational Institute of Scotland, the work of this Committee has been successfully performed. The country has been divided into districts, and in each district forms have been sent to the schools in which the colour of hair and eyes of the scholars have been recorded, and maps prepared showing the relative preponderance of the pigmentation by means of contour lines.

These four committees belong to the Anthropological Section of the Association, the fifth is attached to the Educational Section. It was also appointed at Glasgow in 1901, and is charged to report on the conditions of health essential to the carrying on of the work of instruction in schools. Professor Sherrington is the Chairman and Mr. White Wallis the Secretary. A sub-committee was appointed to collect and tabulate anthropometrical and physiological forms in use in various schools with a view to preparing a typical form for general use, and to collect and tabulate anthropometrical and physiological observations recorded in different schools for a series of years on the same children. We first of all applied to the various schools which had furnished information to the Anthropometric Committee in 1878 to 1883, with the view of ascertaining how far the recording of anthropometric facts had proceeded in the interval of 20 years.

The results were in some respects curious. At Eton College we were informed that there is no systematic collection of information, and no

forms are used. At Westminster School the like condition of things exists, but Dr. Gow, the headmaster, very courteously expressed to us his opinion that measurements ought to be taken and recorded, and it is hoped that he may find it practicable to institute a system. At Radley, in the gymnasium, records are taken on cards, which enable one measurement of the same boy to be compared with another, and include age, height, weight, girth of chest, inflated and otherwise, length of forearm and length of upper arm. At Felstead School, Essex, height, weight, and chest-girth are recorded. In Bootham School, York, the same measurements as at Radley. At King Alfred School, Hampstead, head measurement, mouth, sight, hearing, nose, nutrition and nervous signs are also noted, and the medical officer makes the record. For Marlborough College, reports have been published for 20 years, giving for each boy, height, weight, chest-girth, circumference of head, leg, and arm, and the increase in each since the last measurement. The North London Collegiate School for Girls has a lady medical inspector, who advises as to the physical exercises suitable in different cases, and keeps an excellent and complete record of all the physical data requisite. In reformatory schools, thanks to the energy of Mr. T. G. Legge, the inspector, records have been taken. Mr. Legge expressed a strong opinion that inquiries of this sort are far more likely to get results if the particulars asked for are few and the apparatus to be used perfectly simple and as little like a laboratory instrument as possible. This is undoubtedly very sound advice; for great as is the value of some of the more recondite information asked for by anthropometrical authorities, it is better to have a few broad measurements accurately taken upon a uniform system, than to have a great number of observations hastily taken, vaguely recorded, and varying with the personal qualifications of the observer While great honour is due to the authorities of the North London Girls' School and the King Alfred Society and other bodies which have instituted systematic and complete schemes of observation, and have appointed competent persons to carry them into operation, and their example is one to be followed wherever the means exist, it is not worth while to induce other well-meaning but less competent bodies to make crude and less trustworthy observations, where the means to do better do not exist. The spreading an investigation over a large surface tends to the correction of errors by the principle of compensation, but that is only true where the errors are casual, not where there is a definite cause for them.

When a series of observations on the same individual has been made, the problem arises, what is their significance? The fact that a boy has grown so many inches in one interval of time, and so many in another, is

not in itself illuminating. Mr. Cecil Hawkins, of Haileybury College, has devised an ingenious means of solving the problem. Taking the records of over 40,000 observations and graduating them upon the method devised by Mr. Francis Galton, he has constructed diagrams showing twenty curves of increase from 11 to 18 years of age, one diagram for growth, one for increase of weight, and one for chest-girth. If for the actual figure of height, &c., observed you substitute the number of the curve which represents it for that particular age, you at once see whether growth since the last previous observation has been less or more than the average represented by the standard curves. For example, a boy was for three successive half-yearly periods of the height, weight, and girth represented by curve No. 19 in the three diagrams; that is, all but the minimum, the curves counting downwards from 1 to 20. In the fourth half-yearly period he rose to the 18th curve for height, remaining at 19 for weight and girth. In the fifth he reached the 17th in weight and the 18th in girth. In the seventh he rose to the 17th place for height, and the 16th for weight. In the ninth he fell back a little, being in the 18th curve of weight, and the 19th for girth; but in the tenth he recovered the lost ground. It is easy to see by this means the results of any morbid condition, and to give real practical value to the records.

To resume, I answer the five questions I posed at the beginning of this paper as follows :—

1. The observations most important to be made are the most simple ones: height, weight, and chest-growth. Others are valuable, but these are essential.
2. The method of making them is by the simple instruments recommended by the Anthropometric Committee and Prof. Windle's Committee.
3. They should be compared with each other by the method of Mr. Hawkins.
4. So compared, they will be found exceedingly valuable in tracing the life history of individuals, and in ascertaining the effect of morbid influences upon them.
5. While the teacher is already overburdened with work, the labour which these measurements and observations enforce upon him will to a great extent be its own reward, and may save him the mental strain of a good deal of uphill work in intellectual training that is contra-indicated by the physical facts observed.

[*For Discussion on this Paper, see page 938.*]

PRELIMINARY NOTES OF AN INQUIRY INTO THE PHYSIQUE OF GLASGOW SCHOOL CHILDREN.

By A. K. CHALMERS, M.D.,

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IN the winter of 1902–3 I had occasion to inquire into the death-rate from several causes in houses of various sizes in Glasgow, and this investigation served to bring into prominence the excessive mortality prevailing in the smaller-sized houses, but especially in single apartments. This was completed about the time when the Royal Commission on Physical Training (Scotland) issued their report, and the findings of that Commission suggested to me that along with the high death-rate in these smaller houses there might be coincident variations in the physical development of the children living in them, which would help to explain the excessive incidence of disease among their inhabitants.

In consequence, I suggested to the Chairman of the School Board and to the Convener of the Committee on Health the desirability of an inquiry on lines somewhat similar to those followed by the Commission on Physical Training, and obtained their hearty approval.

In carrying out the inquiry, I was fortunate in obtaining the co-operation of Drs. Kay, Wright Thomson, and Edwards, on whom, indeed, fell the whole work of the inquiry, my own part being limited simply to arranging the details of the examination and making some suggestions as to the tabulation of results. For convenience of comparison, also, I had agreed with Dr. Leslie MacKenzie to adopt the Schedule A which is now incorporated in his volume on the subject, and through his courtesy I was able to obtain advance copies of the schedule before that work was issued.

The first object of the inquiry was to obtain comparative results, and for this purpose three schools were selected, in Cowcaddens District, in Calton, and again in Gorbals, in order that the observations taken there might be compared with corresponding observations taken in more healthy

districts of the city. In order to cover these schools within the time at disposal, the number of children examined in each was limited to 150—save in the south-side school—where, an almost equal number of Jewish children being in attendance, 300 were taken, one-half being Christian and the other half Jews. In all the schools an equal number of each sex was taken, and the numbers were equally distributed over the individual years six to fourteen. The total number examined, therefore, was 750.

In carrying on the work the teachers of the various schools rendered us the most willing help, and filled in many of the details regarding the general mental capacity of each child and its position in the class; the nationality of parents, size of house, &c. Dr. Kay took charge of the measuring and weighing of the children, their condition as to complexion, cleanliness, state of nutrition, and the condition of their teeth, &c. Dr. Edwards tested their hearing, and examined them with special reference to affections of the throat, nose, skin, glands, heart, lungs, and abdomen, and for the detection of deformities; while Dr. Wright Thomson took sole charge of the examination of the eyes.

I began the inquiry in a district where the general death-rate was high, and then took two others in districts where the general death-rate was lower, but still above the mean rate for the city. After this a fourth school was taken in a district with a much lower general death-rate, and finally, through the courtesy of Dr. Spenser, Rector of the High School, I obtained a record of measurements taken there with which to compare some of those taken by ourselves. There was a further advantage also, as well as a point of interest, in the presence of Jewish children in one of the schools drawn from the same district, and consequently housed under similar conditions with the Christian children attending the same school. It was found that by devoting about two hours in the forenoon of three days in the week, about fifty children could be examined per week.

At present I do not propose to do more than indicate in a general way some of the results of this inquiry, and for this purpose I would refer to the Tables which have been prepared by Dr. Kay.

Relation of Height to Weight.

If reference be made to Table I. (Dr. Kay), it will be seen that for most ages the weight in pounds is slightly in excess of the height in inches. But there are exceptions. At age six, boys and girls have fractionally less than one pound in weight for each inch in height, and the same is true of girls at seven and eight. It will be observed also that the weight increased

slightly more rapidly than the height. At age nine the ratio of height to weight is 1 to 1·05 for boys, and 1 to 1·07 for girls; while at fourteen it is 1 to 1·3 for both.

In Table III. it will be seen that the average weight of a male child at age six, measured during the present inquiry, was 39·18 lbs., and the Edinburgh average was 43·6 lbs.; while the standard weight of the Anthropometric Committee of the British Association (1883 Report) is 44·4 lbs., and in our especially selected schools 44·7 lbs. At the age of seven the figures were, Glasgow 46·6, Edinburgh 46·8, and the Anthropometric Committee 49·7. Generally, it may be said that the Edinburgh children measured weigh more at school ages than those of the present inquiry, but between seven and eleven are somewhat less in height, and that the High School boys at most ages are heavier and taller than the children on whom the Anthropometric Committee based their averages. It must be kept in view, however, that you are dealing in the High School with selected boys, who might be called the "better fed." In height and weight the Anthropometric Committee's average is in excess of both towns, confirming in some degree the opinion of that Committee, that the children of towns, at corresponding ages, are smaller and lighter than those brought up in the country. On the other hand, the High School boys, at some ages, are taller and heavier than the Anthropometric figures, and would seem to indicate that *town children under healthy conditions of housing and suitable food are not necessarily dwarfed either in height or weight.* (Tables 7A and 7B, Dr. Kay.)

I should like, further, to ask your attention to the results of the analysis when we attempted to grade the children according to the size of the house in which they lived. This forms a most suggestive part of the inquiry. Grading them as belonging to one room, two rooms, and three rooms or more, the average height of girls from one-apartment houses is 43·4 inches, from the two-apartment houses 49·2, and from three-apartments and upwards 50. The average weight of girls from one-apartment houses is 48·8 lbs., from two-apartment houses 56 lbs., and from three and upwards 58 lbs. In boys corresponding differences are shown. In those from one-apartment houses the average height is 47·7 inches, from two-apartment houses 49, and from three apartments and upwards 50. The average weight of boys from one-apartment houses is 52·9 lbs., from two-apartment houses 56·6, and from three-apartment houses and upwards 59·6 lbs. All this suggests that when we talk of one, two, and three-roomed conditions of living we are dealing largely with the conditions of an economic standard: that just as people live in a one-roomed house, so it

might be said that they are clothed and fed in a one-roomed manner. That is, they are deficient in house-room and in food; but as affecting the children, at least, this latter is of most importance, although the evidence would seem to point to unsuitableness rather than lack of quantity in the food stuffs as most requiring attention.

In any further inquiry, we want precise information as to the nature of the diets used. I have been impressed by what I have already been able to ascertain in this respect, of the conditions of food supplies among the poor, but these are so different from our accustomed standards as to lead to the introduction of a new set of factors. We ordinarily think of food purchased in pounds or ounces, but among the poor it is bought in pennyworths, and has little or no definite relation to weight. It is broken bread or meat parings. With regard to the broken bread, it must be clearly understood that it is not bad bread; on the contrary, it is quite good. Broken bread, such as is bought by the poor, is bread which has been broken in the oven in the process of firing, and is unfit for sale to the ordinary customers. In the same manner, fish which has not found a market during the day is sold at a reduced price; and there are many hundreds of families who are daily living in this way, and consequently in a manner far removed from the ordinary standard of food quantities.

Another suggestion which is the outcome of the inquiry is that if you are to have physical training in schools it is quite obvious that you must either select your children or adapt the exercises to the children. This seems to me essential. You cannot take a child whose weight and other measurements indicate physical unfitness, and put it under a definite routine system of drill without first inquiring if, say, the heart and lungs are in a perfectly healthy state.

With these few remarks, I shall conclude; but I would warn you that the analysis here given is not to be taken as applicable to the children of Glasgow generally, unless supported by an extension of the observations over a larger number of children. Further, that the results arrived at in the course of this investigation indicate to my mind that we have established a clear case for further inquiry, both with regard to the physique of our school children and also with reference to the dietary of the poor.

[*For Discussion on this Paper, see page 938.*]

TABLES SHOWING HEIGHT, WEIGHT, MENTAL CAPACITY, CONDITION OF NUTRITION, TEETH, Etc.

By THOMAS KAY, M.B.

TABLE I.—*Measurements (without clothing) for each year of age, and Relation of Height to Weight, &c.*

Age in Years.	Sex.	Number Examined.	Height.	Weight.	Relation.	Mean		Difference.
						Inspiration in centimetres.	Expiration in centimetres	
6	M.	41	41·632	39·193	·941	56·905	53·496	3·409
	F.	38	41·970	37·842	·901	54·666	51·132	2·534
7	M.	44	45·400	46·267	1·109	60·512	55·995	4·517
	F.	51	44·775	43·719	·976	58·104	53·735	4·369
8	M.	35	47·266	49·060	1·038	62·497	56·762	5·735
	F.	38	46·041	45·662	·979	58·452	53·703	4·749
9	M.	39	49·342	51·911	1·052	64·404	58·308	6·096
	F.	45	48·555	51·859	1·068	61·001	58·861	5·140
10	M.	41	50·593	57·411	1·134	64·817	59·458	5·359
	F.	47	49·518	54·870	1·108	62·349	56·705	5·644
11	M.	46	52·154	60·736	1·164	66·798	60·531	6·267
	F.	42	51·797	62·279	1·202	64·828	59·364	5·464
12	M.	42	53·271	65·328	1·226	68·405	61·867	6·538
	F.	43	54·114	65·553	1·211	66·961	61·205	5·756
13	M.	63	55·669	74·406	1·336	71·419	64·707	6·712
	F.	52	55·866	75·777	1·356	69·503	63·743	5·760
14	M.	11	54·994	72·212	1·311	70·760	63·916	6·844
	F.	11	54·945	72·456	1·318	67·931	62·062	5·869

TABLE II.—*Numbers deviating more than 5 per cent. from Average of Measurements, for each year of age.*

Age in Years.	Sex.	No. Examined.	Deviating Above or Below	Height.	Weight.
Above 6 and under 9	M.	119	Above	11	34
			Below	20	45
	F.	121	Above	16	41
			Below	28	43
Above 9 and under 12	M.	115	Above	15	38
			Below	23	47
	F.	125	Above	15	42
			Below	28	55
Above 12 and under 14	M.	116	Above	17	39
			Below	20	45
	F.	106	Above	15	32
			Below	16	28
Totals ...	M.	350	Above	43	111
			Below	63	137
	F.	352	Above	48	115
			Below	72	126
	Both Sexes.	702	Above	91	226
			Below	135	265
Percentage of Children varying from normal:					
Glasgow			Above	12·9	32·2
			Below	19·2	37·7
Edinburgh			Above	19·1	31·8
			Below	21·	39·5

TABLE III.—(A.) *Weight at each Year in several Schools, with Comparisons.*

Age last Birthday.	MALES.									FEMALES.							
	Milton.	St. James.	Gorbals (Christians).	Gorbals (Jews).	Overnewton.	Average.	Edinburgh Average.	Anthropometric Committee's Standard Average.	6, 7, & 8, Woodside School; other ages Glasgow High School.	Milton.	St. James.	Gorbals (Christians).	Gorbals (Jews).	Overnewton.	Average.	Edinburgh Average.	Anthropometric Committee's Standard Average.
6	38·10	38·14	39·23	37·62	42·85	39·18	43·63	44·4	44·7	38·65	36·87	37·36	39·57	36·75	37·84	42·38	41·7
7	49·88	46·65	46·44	42·5	48·85	46·66	46·84	49·7	46·2	43·91	42·34	43·48	42·	48·85	44·11	45·24	47·5
8	44·	49·95	50·81	49·75	50·69	49·04	49·33	54·9	52.2	47·38	43·	47·17	44·25	46·50	45·66	49·25	52·1
9	51·	54·72	54·65	49·2	49·33	51·78	54·83	60·4	63·5	52·90	52·35	50·64	47·7	55·69	51·85	51·94	55·5
10	54·	56·25	62·31	52·25	62·23	57·40	60·60	67·5	65·9	52·64	54·32	52·95	50·12	64·30	54·86	58·03	62·0
11	57·	60·57	60·78	56·72	66·12	60·23	63·18	72·0	74·7	55·63	66·95	62·01	63·74	63·25	62·31	63·27	68·1
12	58·	67·00	67·07	65·74	68·48	65·25	69·52	76·7	91·9	68·	59·37	68·57	75·	64·41	67·07	70·03	76·4
13	71·	77·76	76·96	69·36	76·80	74·37	75·61	82·6	95·	75·	78·13	72·30	74·90	80·31	76·12	78·56	87·2
14	72·	...	...	72·3	...	72·15	77·36	92·	110·2	65·	...	...	79·6	...	72·3	99·22	96·7

(B.) *Height at each Year in several Schools, with Comparisons.*

6	38·6	41·54	41·94	41·25	44·82	41·63	43·36	44·0	44·6	40·12	41·56	41·13	43·71	43·31	42·04	42·82	42·8
7	45·63	45·15	45·53	44·75	46·16	45·44	44·40	45·9	46·7	43·06	43·75	45·21	45·	46·84	44·17	44·33	44·4
8	43·66	48·93	45·1	47·37	48·25	46·66	45·81	47·	48·8	46·62	46·44	46·35	46·37	47·41	46·63	46·40	46·6
9	47·75	49·20	None given	52·	48·41	49·34	48·11	49·7	53·	48·84	49·16	48·1	47·2	49·46	48·55	46·58	48·7
10	48·28	57·41	50·95	50·	52·30	51·78	50·78	51·8	53·6	48·48	49·94	48·98	47·75	52·43	49·51	49·68	51·
11	50·76	52·13	51·49	52·27	54·11	52·15	51·70	53·5	57·2	50·45	52·60	52·8	57·54	57·58	54·19	52·53	53·1
12	50·98	53·83	53·52	52·72	55·28	53·26	53·91	54·9	61·2	53·92	51·92	54·25	55·	53·46	53·71	53·58	55·6
13	53·84	57·35	56·12	54·27	56·75	55·66	55·88	56·9	62·2	54·62	56·28	55·35	55·27	57·73	55·85	56·29	57·7
14	54·18	...	...	55·8	...	54·99	56·08	59·3	64·	52·89	...	...	57·	...	54·94	59·37	59·8

TABLE IV.—*Mental Capacity, School Attendance.*

Age in Years.	Sex.	Number Examined.	Position in Class during Preceding Term.			Teachers' Opinion of Mental Capacity.					Regularity of Attendance. Absences.		
			Good.	Medium.	Low.	Excellent.	Good.	Medium.	Dull.	Defective.	Under 8 per cent.	Under 16 per cent.	Above 16 per cent
Above 6 and under 9	M.	122	67	45	10	9	63	34	16	—	43	28	34
	F.	127	71	48	8	10	66	40	8	3	40	45	37
Above 9 and under 12	M.	136	83	50	3	32	48	51	5	--	54	54	28
	F.	135	81	52	2	23	54	53	5	--	56	56	43
Above 12 and under 15	M.	117	92	17	8	16	74	19	8	—	49	44	24
	F.	106	81	23	2	10	66	26	4	—	37	35	34
Totals ...	M.	375	242	112	21	57	185	104	29	—	146	126	86
	F.	368	233	123	12	43	186	119	17	3	133	116	114
	Both Sexes	743	475	235	33	100	371	223	46	3	279	242	200
Percentages			63·9	31·6	4·5	13·5	49·9	30·	6·2	·4	38·7	33·6	27·7
Milton			60·9	26·5	12·6	14·6	43·7	25·8	15·2	·7	32·4	30·6	37·
St. James			54·	40·	·6	9·2	44·5	40·	5·6	·7	48·9	31·9	19·2
Gorbals (Jews)			74·2	23·7	·2	11·2	57·2	27·	4·6	—	27·6	47·4	23·
,, (Christians)			66·2	31·8	·2	9·5	56·	31·8	2·7	—	48·7	29·7	21·6
Overnewton			63·6	35·8	·6	27·5	47·7	26·5	2·7	·6	36·4	27·8	35·8
Edinburgh			—	—	—	17·5	39·83	30·33	11·5	·83	77·67	14·67	7·66

TABLE V.—*Teeth.*

Age in Years.	Sex.	Number Examined.	Cleanliness of Teeth.			Number of Children brushing teeth daily.	Regularity of teeth in Number of Children.			Shape of Teeth in number of children.			Decaying Teeth, First set.	
			Good.	Medium.	Bad.		Regular.	Medium	Irregular.	Good.	Medium.	Bad.	Number of Children	Average number of decaying teeth in each child.
Above 6 and under 9	M.	122	13	80	29	1	30	74	15	36	70	16	116	
	F.	128	18	90	20	1	48	59	20	46	77	5	121	
Above 9 and under 12	M.	136	23	87	26	9	55	44	37	77	48	11	123	
	F.	135	34	87	14	7	49	46	40	77	52	5	122	
Above 12 and under 15	M.	117	24	70	23	2	38	45	34	60	59	7	92	
	F.	106	26	69	11	5	44	39	23	64	33	9	79	
Totals	M.	375	60	237	78	12	123	163	86	173	168	34	331	
	F.	369	78	246	45	13	141	144	83	187	162	19	322	
	Both Sexes.	744	138	483	123	25	264	307	169	360	330	53	653	
Percentages			18·6	64·9	16·5	3·3	35·7	41·5	22·8	48·5	44·4	7·1	87·7	
Milton			20·	68·	11·9	0·	29·8	42·4	27·8	38·4	55·6	5·9	95.4	
St. James			15·5	68·3	16·2	2·1	22·5	55·5	21·8	46·5	37·4	14·1	97·9	
Gorbals (Jews)			27·6	63·2	9·2	12·5	48·	32·3	19·7	63·2	36·1	·7	84·2	
Gorbals (Christians) ...			16·2	61·5	22·3	2·	37·2	37·8	25·	47·3	47·3	5·4	89·8	
Overnewton			14·2	70·2	15·6	0·	41·8	41·8	16·4	49·6	46·1	4·3	77·3	
Edinburgh ... 591 ...			11·17	59·39	29·44	5·25	67·85	26·57	5·58	52·45	41·29	6·26		

Table VI.—*Personal Appearance, Cleanliness, &c.*

Age in Years.	Sex.	Number Examined.	Complexion.			Health Appearance.			State of Nutrition.			Brightness and Alertness.			Cleanliness.					
															Clothing.			Body.		
			Ruddy.	Medium.	Pale.	Good.	Medium.	Bad.	Stout.	Medium.	Thin.	Good.	Medium.	Bad.	Good.	Medium.	Bad.	Good.	Medium.	Bad.
Above 6 and under 9.	M.	122	23	73	25	48	66	8	12	95	25	58	61	3	46	69	7	61	47	14
	F.	128	27	72	29	64	54	10	8	93	27	57	68	3	55	61	12	69	46	13
Above 9 and under 12.	M.	136	34	74	28	76	54	6	8	103	25	61	75	...	67	59	10	65	54	20
	F.	135	40	70	25	88	45	2	10	109	16	68	67	...	55	63	17	71	44	18
Above 12 and under 15.	M.	117	27	68	22	82	31	4	9	94	14	45	72	...	55	57	5	58	41	15
	F.	106	28	48	30	66	57	3	6	85	15	45	55	6	41	56	9	50	41	17
Totals ..	M.	375	84	215	76	206	157	18	19	292	64	164	208	3	168	185	22	184	142	49
	F.	369	95	190	84	218	136	15	24	287	58	170	190	9	151	180	38	190	131	48
	Both Sexes	744	179	405	160	424	287	33	43	579	122	334	398	12	319	365	60	374	273	97
Percentages ...			24·1	54·4	21·5	57·	38·5	4·5	5·8	77·8	16·4	44·9	53·5	1·6	42·8	49·1	8·1	50·3	36·7	13·
Milton			22·5	55·6	21·8	37·7	55·	7·3	2·6	80·	17·2	49·	50·3	·7	34·4	53·6	11·9	56·3	34·4	9·3
St. James			21·8	55·	23·2	41·5	53·5	5·	5·6	76·	18·3	46·4	51·4	2·1	42·2	48·6	9·1	55·5	36·7	7·7
Gorbals (Jews)			18·4	50·	31·6	59·9	35·5	4·6	·7	74·3	25·	38·8	60·5	·7	27·5	63·2	9·3	32·9	42·1	25·
„ (Christians) ...			29·	53·4	17·6	65·6	29·7	4·7	1·7	87·2	12·1	43·2	56·1	·7	31·7	59·8	8·5	42·3	49·8	16·9
Overnewton			28·7	58·	12·6	80·	20·	...	18·7	72·	9·3	51·3	48·7	...	81·	19·	...	67·6	31·1	1·3
Edinburgh			24·5	32·67	42·83	34·	46·	19·17	22·67	47·5	29·83	57·	36·	7·	82·5	14·33	3·17	69·	22·5	8·5

TABLE VII.—(A.) *Comparison of Children according to Size of House.*—MALES.

Age in Years.	Size of House in Rooms.	No. Examined.	Mental Capacity.					State of Nutrition.			Cleanliness.			Height.	Weight.
			Excellent.	Good.	Medium.	Dull.	Defective.	Stout.	Medium.	Thin.	Good.	Medium	Bad.		
Above 6 and under 9.	1	7	...	1	3	3	...	...	6	1	1	5	1	43·2	43·5
	2	72	7	38	18	9	...	2	58	12	29	35	8	44·5	44·8
	3	33	4	18	7	4	...	3	21	9	13	19	1	46·2	47·4
	4 & 5	10	...	5	5	...	...	1	8	1	7	2	1	46·	48·1
Above 9 and under 12.	1	3	...	2	1	...	...	...	3	...	2	1	...	49·3	52·
	2	78	20	21	35	2	...	5	59	14	32	42	9	49·3	55·2
	3	41	8	14	19	...	...	4	30	7	24	15	2	50·8	58·2
	4 & 5	14	2	7	4	1	...	1	13	...	95	9	...	51·7	59·2
Above 12 and under 14.	1	5	1	1	...	3	...	...	3	2	2	2	1	50·8	63·2
	2	61	8	37	13	3	...	5	46	10	22	32	6	54·3	69·8
	3	40	8	24	6	2	...	5	24	1	19	18	3	55·6	73·2
	4 & 5	11	2	8	1	...	...	4	5	2	7	3	1	54·1	70·7
Totals ...	1	15	1	4	4	6	...	...	12	3	5	9	1	47·7	52·9
	2	211	35	96	66	14	...	12	163	34	84	109	23	49·3	56·6
	3	114	20	56	32	6	...	12	85	17	56	52	6	50·8	59·6
	4 & 5	35	4	20	10	1	...	6	26	3	19	14	2	50·6	59·3
														Average Height & Weight.	
Per-centage...	1	15	6·6	26·6	26·6	4·0	...	...	80·	20·	33·3	63·	6·6	47·7	52·9
	2	241	16·6	45·4	31·2	6·6	...	4·9	77·2	14·9	34·8	45·2	9·5	49·3	56·6
	3	124	17·5	49·1	28·	5·2	...	10·5	74·5	14·9	45·1	49·1	5·2	50·8	59·6
	4 & 5	35	11·4	57·1	28·5	2·8	...	17·1	74·2	8·5	54·2	40·	5·7	50·6	59·3

TABLE VII.—(B.) *Comparison of Children according to size of House.*—FEMALES.

Age in Years.	Size of House in Rooms.	No. Examined.	Mental Capacity.					State of Nutrition.			Cleanliness.			Height.	Weight
			Excellent.	Good.	Medium.	Dull.	Defective.	Stout.	Medium.	Thin.	Good.	Medium.	Bad.		
Above 6 and under 9.	1	5	...	1	2	1	1	...	3	2	1	3	1	41·4	37·5
	2	78	9	42	21	6	...	8	54	16	33	37	8	44·4	44·
	3	32	2	14	14	1	1	1	25	5	16	14	2	44·6	44·4
	4	13	...	10	3	...	...	1	11	1	10	2	1	45·3	44·
Above 9 and under 12.	1	5	...	3	2	..	...	...	4	1	3	1	1	50·5	54·
	2	82	15	33	31	3	...	6	66	10	32	38	12	48·9	53·6
	3	37	5	19	13	...	...	5	28	4	20	15	2	50·	56·1
	4	11	3	3	5	...	...	2	9	...	6	4	1	50·7	57·3
Above 12 and under 14.	1	8	3	4	1	...	...	...	4	3	1	5	2	57·5	57·3
	2	58	6	29	20	3	...	8	42	8	22	27	9	54·5	70·4
	3	29	4	17	8	...	...	4	22	3	13	12	4	55·1	74·5
	4	11	1	9	1	...	...	2	9	...	5	5	1	55·7	76·9
Totals ...	1	18	3	8	5	1	1	...	12	6	5	9	4	43·4	48·8
	2	218	30	104	72	12	...	22	162	34	87	102	29	49·2	56·
	3	98	11	50	35	1	1	10	76	12	49	41	8	50·1	58·3
	4	35	4	22	9	...	...	5	29	1	21	11	3	50·3	59·4
														Average Height and Weight.	
Percentages...	1	18	16·6	44·4	27·7	5·5	5·5	...	66·6	33·3	27·7	49·8	22·2	43·4	48·8
	2	218	13·3	47·7	33·0	5·8	...	10·0	74·3	15·5	39·9	46·8	13·3	49·2	56·
	3	98	11·2	51·0	35·6	1·0	1·0	10·2	77·5	12·2	50·	41·8	8·1	50·1	58·3
	4	35	11·4	62·8	35·7	...	...	14·2	82·8	2·8	60·	31·4	8·5	50·3	59·4

REPORT ON EXAMINATION OF EARS, NOSE AND THROAT, CHEST, ABDOMEN, Etc., OF 750 SCHOOL-CHILDREN IN GLASGOW.

By ALEXANDER H. EDWARDS, M.B., F.R.C.S.Ed.

THIS clinical examination of school-children was carried out under the supervision of Dr. A. K. Chalmers, Medical Officer of Health for Glasgow, and followed as closely as possible on the lines adopted by Dr. Leslie McKenzie, Local Government Board, in his report of the Royal Commission on Physical Training (*vide* Appendix).

Five schools were visited, and in each 75 males and 75 females at various ages examined; the only exception lay in the instance of Gorbals school, where 150 each of Christian and Jewish children were examined for purposes of comparison, both sections living practically under the same conditions, and both belonging to a comparatively poor social class.

Keenness of Hearing.

The only test conveniently applicable was that of the ticking watch, and it proved rather unsatisfactory on account of the difficulty in obtaining reliable answers from the younger children, also on account of the great variation in volume and intensity of the noise in the different examination-rooms as well as of that in school-rooms, playgrounds, and adjacent streets.

A special room for this clinical examination was never available, and the three medical men engaged were usually all in a small room at the same hours, together with the group of children awaiting examination.

The percentage of "distinctly defective" children is, however, thought to be fairly accurate; under the heading "defective hearing," the results are most probably under-estimated, as for the above reasons accurate results were impossible.

The highest percentages of combined defective and very defective hear-

ing were among males at the ages between 6 to 9, and 9 to 12 years, these being almost equal. These were followed by a percentage of 29·9 per cent. shown by females at ages from 9 to 12 years.

The most commonly associated cause was cerumen, occurring in 16·33 per cent.; next, enlarged tonsils, 6·83 per cent.; and in 750 children there occurred 22 cases of otitis media with perforation.

Adenoids alone, enlarged tonsils, and enlarged tonsils and adenoids combined occurred with moderate frequency as causes.

Of the various schools, Milton Street showed 11 cases of otitis media with perforation, Gorbals 5, Overnewton 4, St. James 2, Jewish 1.

All the causes of more or less defective hearing were most common in the Milton Street school, which represents the poorest class of children examined, though probably not the poorest in Glasgow.

In the Jewish section a total of 25·33 per cent. represents the combined defective and very defective hearing, as against 27·34 per cent. in the aggregate of the other schools.

It is thought that the percentage of those with defective hearing is considerably understated, and that most probably the instances of ear disease are more numerous than stated in these tables, for there was great difficulty in examining many of the patients; when scholars would not or could not submit to a detailed examination of ear or throat, frequently owing to nervousness, the examination was never persisted in for obvious reasons.

All the cases of otitis media were in a neglected condition, required active treatment, and the children were advised to inform their parents so that treatment could be at once commenced.

NOSE AND THROAT.

Enlarged Tonsils.—The largest percentages were found at the Milton Street and Gorbals schools. In them the percentages were 32·66 and 31·33 per cent. respectively; whilst amongst the Jewish at Gorbals they occurred in 24·66 per cent. In the aggregate of Christian children they were most common among boys at the ages of 6 to 9 years, and were more common in boys than in girls (82 to 69) at all ages; among Jewish 12 to 25.

Enlarged Tonsils and Adenoids.—Frequency: Milton Street, 21 boys, 18 girls; Jewish, 18 boys and 20 girls. These are the highest numbers, the lowest being obtained at Overnewton school, with 21. Altogether there was a preponderance among boys of 65 to 59 (Christian).

Adenoids only were most common of all among the Jewish children;

there were 29 affected, 16 boys and 13 girls. This is closely followed by Milton Street, which showed 26 cases.

All cases of tonsillar enlargement, however small the enlargement, were reported, but for all purposes it was not always easy to examine the throat thoroughly. In a moderate number of cases with enlarged tonsils excision was indicated, especially as in many of these there was coexistent deformity of the chest. All undoubted instances of *mouth-breathing* were observed and noted; the highest number reached was at St. James, 86; the next, at Milton Street, 84, where there was also the largest number of cases of nose and throat trouble. The lowest number, which was found in Overnewton school, where the associated causes were least frequent, was 45. The total number of male mouth-breathers was 142, as against 123 female, or, including Jewish children, 169 males and 155 females.

These were all instances where a properly applied system of breathing exercise was of necessity. The percentages of the three principal conditions under "nose and throat" are rather higher than those observed in the schools of Edinburgh, and very much higher than those of Aberdeen.

Skin Diseases.

These comprised the following: pediculosis; eczema of face and body or limbs; xeroderma and ichthyosis; ringworm of scalp and face. The first two forms were presented most frequently.

An ichthyotic condition was observed in five cases (very marked with hide-bound skin over extensor aspects of legs in one), and the degree known as xeroderma in six more.

Milton Street again showed the highest total of cases, 18 per cent., principally cases of pediculosis. St. James, 8·6 per cent.; Gorbals (Jewish and Christian), 6 per cent.; Overnewton, 2·6 per cent. In the aggregate boys were more affected than girls, 36 to 26.

Glands.

All cases of small shot-like glands were reported, and, when submaxillary or superficial cervical, were always associated with decaying teeth. The worst result was seen in Milton Street, where 29·3 per cent. were affected; and the best at Overnewton, where 12 per cent. showed more or less enlargement.

The glandular enlargement at the latter school is practically equal to that found among the Jewish at Gorbals school, it being of interest to state that the latter belong to a comparatively poorer class of the community, living also in houses with less accommodation, but the con-

dition of the teeth in general was found to be better among the Jewish section.

Heart.

Cases of mitral incompetence were the most numerous in the total of 35, of whom 21 were boys and 14 girls.

Some cases of functional disease with hæmic bruits were found in girls, and a few of irregular cardiac action in boys.

Added to the above were five cases among the Jewish children.

A few typical examples are given:—

1. Girl: age $7\frac{9}{12}$; height $46\frac{1}{2}$ in.; weight 44 lbs.; very thin; slight pigeon-chest deformity; enlarged tonsils and a mouth-breather. Mitral incompetence.

2. Girl: age 14 years; height 54 in.; weight 56 lbs.; very thin; irregular in attendance; slight scoliosis; muscles generally flabby and weak. Mitral systolic bruit, coarse in quality; pulse of small volume, low tension, but regular in force and rhythm.

3. Boy: age 9; weight 46 lbs.; height 46 in.; good intelligence though often a truant. Astigmatic; very thin and pale; enlarged glands in groins; mitral incompetence; would require good feeding.

4. Boy: age 14 years; height $58\frac{1}{2}$ in.; weight 74 lbs.; irregular in attendance; right eye hypermetropic; left eye myopic. Very irregular cardiac action and pulse at wrist irregular in tension and rhythm. He admits that he is a cigarette smoker.

5. Boy: age 14 years; with lordosis, scoliosis, rickets of both femora and slightly deformed rachitic chest; rapid and irregular action of heart low tension, irregular pulse at wrist; a cigarette smoker.

6. Another case of rapid, weak, irregular, cardiac rhythm; and diminished intensity of sounds in a boy who is a cigarette smoker.

These are fairly representative cases, but the space of this report prevents all from being described; in most of these 35 cases of cardiac disease the general nutrition was under the normal.

Frequency: Milton Street, 12 cases; St. James and Gorbals, 9 each; Overnewton and Jewish, 5 each, totals are 24 males and 16 females in 750.

An inquiry was made at the Milton Street school, regarding the smoking of cigarettes among boys from ten and upwards; a large proportion of these boys admitted indulgence in the habit, though to what extent it was difficult to ascertain.

All cardiac cases were undergoing exercises at least one hour weekly, such as drill, Chesterton exercises, wand drill, light dumb-bells, etc.

Lungs.

The difficulty in examination of the lungs in the rooms placed at disposal was great, on account of same circumstances cited above.

The number exhibiting undoubted disease of lung was 25 (15 boys and 10 girls).

Frequency: Milton Street, 13: Gorbals, 6; St. James, 5; Overnewton, 1; Jewish, 1.

Cases.—1. Girl: æt. 12$\frac{5}{6}$; height 56 ins.; weight 71$\frac{1}{2}$ lbs.; attendance very bad. Patient is pale, thin, and anæmic looking, dulness and bronchial breathing at right apex in front, and right infraclavicular region; otitis media, defective hearing and enlarged tonsils. This was considered to be tubercular lung disease.

2. Girl: æt. 11$\frac{5}{12}$; height 48$\frac{1}{8}$ in.; weight 50$\frac{1}{2}$ lbs.: attendance bad. Thin; often has "sore eyes" (strumous ophthalmia); granular pharyngitis; enlarged tonsils; rachitic chest and genuvalgum (double); a right apical catarrhal condition is present and is probably tubercular.

There were other cases of tubercle of lung, and numerous cases of mild bronchitis.

In some of the cases of bronchitis with cough, the additional conditions of otitis media, decaying teeth, enlarged glands, rachitic or pigeon-chest were present, singly.

A complete clinical examination of the cases as in hospital, was, however, impossible. Lung conditions occurred most frequently in boys, the proportion being 3 to 2.

Abdomen.

Here 8 cases of considerably enlarged abdomen were noted, and approaching very closely to the condition known as pot-belly, but in none were enlarged mesenteric glands satisfactorily determined. In all, however, there was a marked degree of mal-nutrition of limbs and trunk.

Cases.—1. Boy: age 6 years; height 41$\frac{1}{2}$ ins.; weight 36 lbs. Very thin; has bad teeth; enlarged sub-maxillary glands; slightly enlarged tonsils; slight rachitic chest; enlarged femoral epiphyses (lower) and marked "pot-belly."

2. Boy: age 11$\frac{9}{12}$; height 50$\frac{1}{2}$ ins.; weight 65 lbs. Clothing very bad; body very dirty; myopic; defective hearing; enlarged tonsils; pediculosis; enlarged sub-maxillary glands, with decaying teeth; slightly rachitic chest, and large pot-belly.

Two cases of *oblique inguinal hernia* were seen in boys, one right and the other left-sided; one was present in a boy of 13 years, the other

of 9 years. Five cases of urinary incontinence, of the nervous variety probably, were noticed, and all were ill-nourished and unhealthy looking, *e.g.*, Boy: age $6\frac{1}{3}$ years, very unhealthy and pale in appearance; attendance very irregular owing to "illness"; height 37 in.; weight $32\frac{1}{2}$ lbs.: of dull intellect; very dirty and astigmatic; a mouth-breather, with marked double genuvalgum: with rachitic chest and during examination dribbling of urine.

Deformities.

No case of congenital deformity was found.

Of acquired deformities, the division of those of the chest into those due to rickets and those due to respiratory obstruction is only a convenient one, as many of the latter may be largely due to rachitic softening, though in these no positive evidence was found. All slightly deformed chests, in which costo-chondral thickenings were found, are included in the first column; in the second are found all, even slightly deformed chests, where no objective rachitic phenomena presented, and where such conditions as enlarged tonsils, etc., were present. Some degree of deformity of chest was present in 112 of 600 Christian children, or 18·6 per cent.; whilst 26 of 150 Jewish children, or 17·3 per cent., showed the same.

Of these former, 41 boys and 27 girls were distinctly rachitic, whilst in 33 boys and 11 girls the causes seemed more referable to respiratory obstruction. Relative frequency of deformities of chest:—

Milton Street	37	male and	female.
St. James	32	„	„
Gorbals	29	„	„
Jewish	26	„	„
Overnewton	14	„	„

90 males and 48 females out of 750 suffered from deformity of chest.

Affecting the lower limbs, in order to include enlargement of epiphyses where the limbs were straight, and to include cases where the tibia or tibiæ were alone affected, the arbitrary division has been made of rickets of femora and tibiæ. In the former the curvature was usually outwards and to the right, in the latter forwards, in both the convexity being forwards.

In genuvalgum cases, usually double, it was observed that there was always an appearance of flat-foot, but on closer examination it was impossible to satisfy one's self there was much if any depression of the arch of the foot on either side.

In rickets of lower limbs, 16 boys were affected and 18 girls, among 600; and among 150 Jewish children 2 boys and 1 girl.

Scoliosis.—Here 31 cases were found among girls, 16 of whom were at ages between 12 and 14 years, whilst 5 boys showed a similar lesion.

In all, the condition was one of mal-nutrition and imperfect muscular development It was very noticeable as being more frequent in its occurrence in girls approaching or at puberty.

One case of typical flat, rickety pelvis was noticed in a girl of 14 years; she was exceptionally well-developed and had a large prominent abdomen, but was muscular and healthy in appearance.

Flat-foot.—This is restricted to cases in which there was no genu-valgum; 11 of these were girls, and 4 boys at various ages.

Relative frequency of all deformities (male and female) in the various schools: Milton Street, Cowcaddens, 68; Gorbals, 58; St. James, 49; Jewish (Gorbals) 43; Overnewton, 21; total, 239. This represents the total number of deformities, these being distributed over 169 Christian and 36 Jewish children, *i.e.*, 16 per cent. of Christian and 24 per cent. of Jewish children were deformed to a greater or lesser degree.

As was expected the largest number was found in Milton Street school, which educates children derived from one of the poorest districts in Glasgow. It was not unexpected that the children in the Overnewton school showed least deformity, as these children belong to a class of working people whose earnings are considerably higher than those in the Cowcaddens (Milton Street school) area. In the matter of housing, open spaces and parks, the Overnewton area has much the advantage also.

A comparison between Christian and Jewish children examined at the school of Gorbals, these children residing in the same district, is interesting. The preponderance of acquired deformity is rather in favour of the Jewish; the figures being: 43 Jewish and 58 Christian each in 150 examined; among the Jewish also there were less cases of defective hearing, 38 to 47; less ear-disease, 11 to 17; less enlarged tonsils, 37 to 47; but more combined enlarged tonsils with adenoids, 38 to 31; and considerably more adenoids, 29 to 15, almost double the proportion; also more mouth-breathers, 59 to 50; less glandular disease, 19 to 22; less cardiac disease, 5 to 9; less lung disease, 1 to 6; less abdominal enlargement, 2 to 5. The aggregate here shows more nose and throat trouble in the Jewish, 107 to 95, and considering that usually the condition of the teeth in the Jewish children was better than in the Christian children, the difference in glandular enlargement which was usually sub-maxillary is small.

The greatest care must be exercised in making deductions from the above comparison, but the physique of the Christian children seemed on the whole considerably better, the Jewish appearing to be less robust.

One is inclined to the belief that if a much larger number of each set was examined there might be less disease generally among the Jewish, as from personal observation the writer thinks that these children are fed more in harmony with the laws of nature during the first few years of life, and especially during the first year.

A large percentage of the deformities noticed in this investigation were due to rickets, *e.g.*, 23 per cent. males and 13 per cent. females had more or less deformity of chest of the "pigeon" or "rachitic" types, whilst 8.8 per cent. males and 3.4 per cent. females apart from the above showed deformity principally due to obstruction from tonsils enlarged and adenoids.

As regards gross deformity of the lower limbs, about 3½ per cent. each of males and females showed this, as genuvalgum or genuvarum. As rickets is a disease of the first years of life in its onset, a few points might here be considered in relation to its ætiology.

It appears to be most common among the poorest classes of the community, *i.e.*, among the class where the weekly earnings are lowest, and where the social, moral and sanitary conditions are at their worst. It will be generally admitted that rickets is a disease of mal-nutrition from faulty feeding principally, whatever the co-related causes are.

Probably the majority of women of the poorest class, and many of the lower middle class are more or less unhealthy during pregnancy and lactation, this arising from various causes such as imperfect or improper feeding, from immoderate use of alcoholic liquors, and perhaps not a small proportion from the deteriorating influence of syphilis. Another important factor in the production of the disease is probably that so common in Glasgow among the poorest classes, viz.: the practice of allowing infants about or under one year to be fed to a greater or less extent on the food of adults in the same house, *e.g.*, articles of diet such as potatoes, tea, bread, etc.

The proper feeding of infants is a matter of the greatest importance, and one about which the lower classes are lamentably ignorant.

The effect of the immoderate use of alcohol is at least two-fold, viz.: in depriving of the means to purchase enough food of proper quality, and also by directly damaging the health of the nursing mother, indirectly affecting that of the infant. To what extent the immoderate use of liquors is responsible for causation of rickets it is well-nigh impossible to estimate as it is an indirect cause.

In conclusion, the points which seem of importance in relation to the prevention of rickets, are in the writer's opinion :—

1. The complete control by the corporations (of large cities at least) of the milk supply, so that the milk shall be of uniform and good quality.

2. The feeding of poor children at the schools where they are educated, this being a matter of greater importance than that of physical drill of dumb-bell and other exercises.

3. Education of the older female children in plain cookery, and the feeding of infants.

4. Education of the older children in hygiene with special reference to the use and abuse of alcoholic liquors, tobacco, tea, etc., etc.

[*For discussion on this paper see page* 938.]

Age-Groups.	Sex.	Number examined.	Keenness of Hearing. Average of both ears. Distance at which watch heard.			Percentage with	Diseases and Causes.					
			Ten feet and normal.	Five feet and under ten. Defective.	Under five feet. Distinctly defective.	Defective hearing.	Otitis Media and Perforation.	Chronic Catarrh.	Cerumen.	Enlarged Tonsils only.	Enlarged Tonsils and Adenoids.	Adenoids only.
Above 6 and under 9.	M.	98	65	28	5	33·67	2	2	20	6	9	2
	F.	107	84	20	3	21·49	4	2	16	9	4	2
Above 9 and under 12	M.	108	72	29	7	33·33	5	5	20	3	5	7
	F.	107	75	27	5	29·90	1	7	17	8	4	2
Above 12 and under 15	M.	94	75	12	7	17·75	5	2	11	4	2	1
	F.	86	62	17	7	27·9	5	6	14	11	6	2
	M.	300	212	69	19	28·25	12	9	51	13	16	10
	F.	300	221	64	15	26·43	10	15	47	28	14	6
Totals		600	433	133	34	27·34	22	24	98	41	30	16
Percentages			72·16	22·16	5·16	—	3·66	4·0	16·33	6·83	5·0	2·66

GLASGOW (Gorbals School). *Ears and Hearing.* Jewish Children.

Age-Groups.	Sex.	Number examined	Hearing (as in other groups).			Number with Defective Hearing.	Causes.					
			10 feet +	5 feet, under 10.	— 5 feet.		Otitis Media.	Chronic Catarrh.	Cerumen.	Enlarged Tonsils.	Enlarged Tonsils & Adenoids.	Adenoids only.
Above 6 and under 9.	M.	24	20	4	—	4	—	—	1	1	—	—
	F.	24	20	2	—	2	—	—	1	—	—	—
Above 9 and under 12.	M.	28	16	9	3	12	1	3	4	4	1	2
	F.	28	17	7	4	11	—	3	4	4	—	1
Above 12 and under 15.	M.	23	18	2	3	5	—	1	4	1	—	—
	F.	23	19	0	4	4	—	3	1	1	—	—
	M.	75	54	15	6	21	1	4	9	6	1	2
	F.	75	56	9	8	17	—	6	6	5	—	1
Totals		150	110	24	14	38	1	10	15	11	1	3
Percentages			73·33	16·0	9·33	25·33	·66	6·66	10·0	7·33	·66	2·0

Age-Groups.	Sex.	Number Examined.	Chest.		Lower Limbs. Long bones.		Vertebral Column.		Feet.	
			Rickets.	Principally from Respiratory Obstruction.	Femora.	Tibiae.	Scoliosis.	Kyphosis.	Flat.	Hallux Valgus.
Above 6 and under 9.	M.	98	13	13	4	6	—	—	1	—
	F.	107	14	8	10	7	5	1	5	—
Above 9 and under 12.	M.	108	15	7	6	6	1	—	1	—
	F.	107	5	3	4	6	6	1	4	—
Above 12. and under 15.	M.	94	13	13	3	3	4	2	2	1
	F.	86	8	0	4	5	14	—	2	1
	M.	300	41	33	13	15	5	2	4	1
	F.	300	27	11	18	18	25	2	11	1
Totals		600	68	44	31	33	30	4	15	2
Percentages			11·33	7·33	5·16	5·5	5·0	·63	2·5	·33

GLASGOW. (Gorbals School). *Deformities.* Jewish Children.

Age-Groups.	Sex.	Number Examined.	Chest.		Lower Limbs.		Vertebral Column.		Flat-foot.
			Rachitic.	Due principally to Respiratory Obstruction.	Femora.	Tibiae.	Scoliosis.	Kyphosis.	
Above 6 and under 9.	M.	24	3	—	1	1	—	—	2
	F.	24	2	—	—	1	2	1	1
Above 9 and under 12.	M.	28	6	—	—	—	—	—	2
	F.	28	1	1	—	—	2	—	1
Above 12 and under 15.	M.	23	7	—	—	1	—	—	1
	F.	23	5	1	—	—	2	—	1
	M.	75	16	—	1	2	—	—	5
	F.	75	8	2	...	1	6	1	3
Totals		150	24	2	1	3	6	1	8
Percentages			16·0	1·33	·66	2·0	4 0	·66	5·33

Age-Groups.	Sex.	Number examined.	Number Suffering from Disease of :									Total number suffering from Disease.	Acquired Deformities (number of children).
			Skin.	Glands.	Bones.	Heart.	Lungs.	Abdom. Organs.	Ears.	Nose and Throat.	Other Diseases.		
Above 6 and under 9.	M.	98	10	32	1	7	9	5	4	70	38	88	39
	F.	107	10	22	—	5	7	1	6	58	7	78	29
Above 9 and under 12.	M.	108	9	26	—	5	6	—	10	65	37	91	27
	F.	107	7	12	1	2	2	2	8	60	4	76	21
Above 12 and under 15.	M.	94	11	9	—	9	0	—	7	66	31	73	32
	F.	86	6	13	—	7	1	—	7	50	5	68	26
	M.	300	30	67	1	21	15	5	21	201	106	252	93
	F.	300	23	47	1	14	10	3	21	168	16	222	76
Totals		600	53	114	2	35	25	8	42	369	122	474	169
Percentages			8·83	19·0	·33	—	4·16	1·33	7	61·5	20·33	79·0	28·16

GLASGOW (Gorbals School). *Diseases.* Jewish Children.

Age-Groups.	Sex.	Number Examined.	Number suffering from disease of—									Total number of Children diseased.	Acquired deformities.
			Skin.	Glands.	Heart.	Lungs.	Abdomen.	Ears.	Nose and Throat.	Other diseases.	Bones.		
Above 6 and under 9.	M.	24	3	3	0	0	1	0	15	3	—	22	5
	F.	24	2	7	1	0	0	0	18	2	—	20	6
Above 9 and above 12.	M.	28	3	3	1	0	1	4	16	5	—	21	8
	F.	28	0	3	0	1	0	0	22	2	—	22	5
Above 12 and under 15.	M.	23	0	1	2	0	0	1	16	4	—	22	5
	F.	23	1	2	1	0	0	3	20	1	—	17	8
	M.	75	6	7	3	0	2	5	47	12	—	65	18
	F.	75	3	12	2	1	0	3	60	5	—	59	19
Totals		150	9	19	5	1	2	8	107	17	—	124	37
Percentages			6·0	12·66	3·33	·66	1·33	5·33	71·33	11·33	—	82·66	24·66

GLASGOW. *Diseases of Nose and Throat.* Total examined 600.

Age-Groups.	Sex.	Number Examined.	Enlarged Tonsils. only.	Enlarged Tonsils and Adenoids.	Adenoids only.	Granular Pharyngitis.	Mouth Breathers.
Above 6 and under 9.	M.	98	34	19	14	3	57
	F.	107	26	17	13	2	42
Above 9 and under 12.	M.	108	20	22	19	4	41
	F.	107	22	24	13	3	51
Above 12 and under 15.	M.	94	28	24	8	4	41
	F.	86	21	18	11	1	30
	M.	300	82	65	41	11	142
	F.	300	69	59	37	6	123
Totals		600	151	124	78	17	265
Percentages...			25·16	20·66	13·0	2·83	44·16

GLASGOW (Gorbals School). *Nose and Throat.* Jewish Children.

Age-Groups.	Sex.	Number Examined.	Enlarged Tonsils.	Enlarged Tonsils and Adenoids.	Adenoids only.	Granular Pharyngitis.	Mouth-breathers.
Above 6 and under 9.	M.	24	2	6	7	—	11
	F.	24	8	5	5	—	13
Above 9 and under 12.	M.	28	4	6	6	—	8
	F.	28	10	7	5	—	11
Above 12 and under 15.	M.	23	6	6	3	1	8
	F.	23	7	8	3	2	8
	M.	75	12	18	16	1	27
	F.	75	25	20	13	2	32
Totals		150	37	38	29	3	59
Percentages			24·66	25·33	19·33	2·0	39·33

REPORT OF AN EXAMINATION OF THE EYES OF 750 GLASGOW SCHOOL CHILDREN.

By H. WRIGHT THOMSON, M.D.

IN submitting this report on the condition of the eyes and eyesight of the 750 Glasgow school children whom I have had the opportunity of examining during the past few months, I have, for the most part, confined myself to the statement of facts. I have avoided theorising as to causation and association, as it is intended that the investigation shall be proceeded with, and greater numbers will provide more reliable data from which to draw conclusions. The present figures, however, are sufficient to prove the clamant need which there is in Glasgow for regular medical inspection of school children, if they are to have the best chance, not only during the period of their education, but in their work in after life.

Comparison with the results of similar investigations in Edinburgh and Aberdeen is of interest. The tabulation which I have adopted is somewhat different from that in which they were presented (Report of the Royal Commission on Physical Training, Scotland), but the chief difference of importance is in regard to acuteness of vision. This is determined by finding the smallest print, on a standard card, which can be read at a distance of 6 metres, or 20 feet. Each line is marked in figures indicating the number of metres at which it should be read. If a person reads the one marked 6, his sight is normal, and is represented as $\frac{6}{6}$; if he only reads the one marked 12, his visual acuteness is $\frac{6}{12}$, and so on. Now, in the Edinburgh and Aberdeen tables all vision less than $\frac{6}{6}$ is classified as defective. I think this is hardly fair, especially in the case of young children. They are taught reading by the phonetic system: they do not learn the names of the letters at first, they only know the sounds of them, and the capital letters are the last to be learned. They are, therefore, for some time at least, not familiar with the capital letters, and

their names and their mere recognition may constitute a difficulty which will lead to a false impression of defective vision. There is apt to be a confusion between what the child does not see and what he sees but does not know. Again, allowance must be made for the excitement which an examination of any kind causes in both the younger and older children. Also, there is the variation in illumination which is inevitable when different schools have to be visited in all kinds of city atmosphere. I have, therefore, not called vision defective unless the child could read no further down than the line, marked 12, *i.e.*, $V=\frac{6}{12}$. Such cases I have kept separate as cases of moderate defect. Then all cases in which the vision is $\frac{6}{18}$ or less are classified together as decidedly defective. *Any child whose acuteness of vision is only* $\frac{6}{18}$ *is in urgent need of treatment.*

In all cases each eye was treated separately, and the child was classified according to the vision of the better eye. That is to say, if the vision of one eye was normal, he was classified normal, and thus the figures in the tables represent the actual seeing ability of the children with both eyes open. A separate table (VI.), however, shows the number of these cases. It is sometimes possible to train such defective eyes if they are discovered early enough.

A similar rule has been followed with regard to the refraction of the eyes: that is, the better eye has always determined the classification. The refraction was estimated by the direct method of examination, and often confirmed by retinoscopy.

The age groups are three in number. The first comprises children above 6 years of age and under 9; the second above 9 and under 12; the third above 12 and under 15. In each school 150 Christian children were examined, and in Gorbals 150 Jews in addition. The numbers were as nearly as possible equally divided between the sexes and among the groups. Great difficulty was experienced in this respect with the oldest group. Most of the children leave school immediately after they are 14 years of age; hence this group, while numbering 50 in each school, was usually made up largely of children of 12 and 13 years of age.

In all 751 children were examined, and of these 150 were Jews. Table I. gives a comprehensive report of the results, boys and girls being classed together.

With regard to visual acuteness and shortsightedness, the Jews differ so much from the others that they are in most of the succeeding tables treated separately.

Table II. shows the total numbers for Glasgow (excluding Jews), and a comparison with the Edinburgh and Aberdeen results. In each city 600 children were examined, and the grouping was the same.

Table III. A shows the numbers of all ages for each condition in each city; and Table III. B, by having the results in percentages, allows of comparison not only between the three cities, but also with the Jewish children.

From these tables it appears that, as far as eyesight is concerned, Glasgow children are in worse condition than those in either Edinburgh or Aberdeen.

It is not easy to define exactly what is the normal condition of a young child's eyes. Infants are all hypermetropic, or longsighted, and the gradual development from this to what, for later life, is normal, takes some years, and is not complete at the beginning of school life. Hence, in the first age group, the occurrence of hypermetropia is not of great significance. Astigmatism, however, no matter how young the child may be, is a defect, and still more is myopia. *The young child who is discovered to have myopia, or shortsight, ought to become an object of special care, and his education should be under medical control.* 10·6 per cent. of the Glasgow Christian children, and 32·6 per cent. of the Jewish children, were found to be already myopic. It is in the older children that myopia reaches its highest numbers. Aberdeen has the smallest proportion of myopia, Edinburgh and Glasgow are alike.

Hypermetropia does not call for treatment in the younger children unless it gives rise to actual symptoms, such as headaches, inflammation of the eyes or eyelids, or obvious defective vision. In the older children, from 9 years onwards, it would be better to be relieved by glasses if of more than 2 dioptres, even though it were causing no apparent symptoms. The eyes are working under undue strain. Hypermetropic astigmatism, if causing defective vision or other symptoms, should certainly be treated by glasses, no matter how young the child may be. It is to be remembered that in certain cases it is liable to develop into myopia.

Squint was found in 3·6 per cent. of the Christians, and in 2 per cent. of the Jews. Hardly any of the cases were undergoing any treatment, yet it is in early childhood that a cure is most likely to be obtained.

Inflammatory conditions of the eyelids and conjunctiva were found in 7 per cent. of the Christians, and in 10 per cent. of the Jews. These were all in need of treatment, yet only one or two were being looked after. In this group is included strumous ophthalmia, a very common disease among poor children. It is largely the result of bad feeding, and often leaves the eyes permanently damaged. 2 per cent. of both Christians and Jews had defective vision due to scars on the cornea, the result of this disease. Aberdeen children are shown to be much freer from such corneal scars than those in Edinburgh and Glasgow.

From an administrative point of view, the result of the examination of the 600 Christian children may be expressed thus: 7 per cent. had inflammation of the eyes or eyelids, all requiring treatment; 17·5 per cent. had $\frac{1}{3}$, or less than $\frac{1}{3}$, of normal visual acuteness; 13·1 per cent. had only $\frac{1}{2}$ of normal vision; and 69·5 per cent. had normal vision.

10·6 per cent. had myopia in some form. These all urgently required glasses, but not one had them. 19·5 per cent. had hypermetropic astigmatism; and 20·1 per cent. had 2 dioptres, or more, of hypermetropia. It is safe to say that at least half of these required glasses, *i.e.*, 20 per cent. of the whole.

Then 3·6 per cent. had squints, for which nothing was being done.

In other words, 34·2 per cent. of the 600 children were in need of medical ophthalmic treatment. In the case of the Jewish children, 32·6 per cent. were myopic, and, reckoned in the same way as the Christians, 47·6 per cent. of the 150 required treatment.

In this connection it may be stated that in Milton, St. James', and Gorbals Schools, out of 3,630 children, only 2 per cent. of the children are at present wearing glasses.

Comparison of the different schools does not bring out much variation as regards visual acuteness and refraction. It will be seen, however, that in Overnewton School, in which the children are comparatively in the best circumstances, only one case of corneal scar was found. Also, inflammatory conditions of the eyelids and conjunctiva were less common than in the other schools.

In addition to the children otherwise examined, I took the opportunity, in three of the schools, of testing the eyes of the highest classes—*i.e.*, of those about to leave school and go out to work. The children were practically all between 13 and 14 years of age. Table IV. shows the result. Taking the average for the three schools, excluding the Jews, 15 per cent. had $\frac{1}{3}$ or less of normal vision; 10 per cent. had myopia; and only 2 per cent. were wearing glasses.

Table V. shows the relation of the two sexes as regards visual acuteness and refraction. In both respects the girls are slightly worse than the boys. It will be noticed that myopia is markedly common in girls.

Lastly, Table VI. shows the cases in which the vision of one eye was normal and the other defective. The total number of such was 56, or 7·5 per cent., and it is to be remembered that in the other tables these cases appear as having normal vision.

TABLE I.

Name of School.	Milton.			St. James'			Gorbals (Christians).			Gorbals (Jews).			Overnewton.		
Age Group	6–9	9–12	12–15	6–9	9–12	12–15	6–9	9–12	12–15	6–9	9–12	12–15	6–9	9–12	12–15
Normal Vision, *i.e.*, V = $\frac{6}{6}$ or $\frac{6}{9}$	32	28	39	38	39	32	30	39	33	28	24	24	33	36	38
V = $\frac{6}{12}$	8	11	3	5	5	7	10	5	5	6	13	3	9	6	5
V = $\frac{6}{18}$ or less	10	11	8	8	6	11	8	8	12	14	15	23	6	10	7
Emetropia or low Hypermetropia, classed together as Normal	22	22	23	26	24	24	20	26	22	17	17	20	21	27	32
Hypermetropia of 2 Dioptres or more	18	5	7	14	11	12	9	10	8	9	11	8	14	6	7
Hypermetropic Astigmatism	6	16	8	7	10	7	14	8	15	6	8	7	10	10	6
Myopia, Myopic Astigmatism, or Mixed Astigmatism	4	7	2	4	5	7	5	8	5	16	16	17	3	9	5
Convergent Squint	3	2	1	1	4	3	...	3	1	1	1	1	1	...	3
Divergent Squint	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...
Inflammation of Eyelids or Conjunctiva	4	5	1	3	4	2	5	2	5	3	3	8	4	1	1
Phlyctenular Ophthalmia	2	1	1	...	...	...	1	...	...	...	1	...	...	...	...
Corneal Opacities	4	...	1	...	1	...	3	2	...	1	1	1	...	1	...
Styes	1	...	2	...	1	2	...	...	1	...	...	...	...	...	...
Other Conditions*	2	...	...	...	...	1	...	...	...	...	...	1	...	...	...
Number Examined	50	50	50	51	50	50	48	52	50	48	52	50	48	52	50

*These include 1 case of congenital cataract, 1 case of leucoma adherens and 1 case of lachrymal disease

Table II.

	Number in Age Groups									A. Total Numbers.			B. Percentages.			
	Glasgow (Excluding Jews).			Edinburgh.			Aberdeen.			Glasgow.	Edinburgh.	Aberdeen	Glasgow.	Edinburgh.	Aberdeen.	Jews.
Age Groups	6-9	9-12	12-15	6-9	9-12	12-15	6-9	9-12	12-15	...	...	...	...	...	...	...
Normal Vision, *i.e.*, V = $\frac{6}{6}$ or $\frac{6}{9}$ ...	133	142	142	170	169	171	150	168	171	417	510	489	69·5	85	81·5	50·6
V = $\frac{6}{12}$ ...	32	27	20	17	15	10	25	18	14	79	42	57	13·1	7	9·5	14·6
V = $\frac{6}{18}$ or less ...	32	35	38	12	19	19	25	14	15	105	50	54	17·5	8·3	9	34·6
Emetropia or low Hypermetropia ...	89	99	111	87	90	95	69	80	114	299	273	263	49·8	45·5	43·9	32
Hypermetropia of 2 Dioptres or more ...	55	32	34	74	51	43	83	87	49	121	168	219	20·1	28	36·5	16·6
Hypermetropic Astigmatism ...	37	44	36	17	33	26	35	22	25	117	76	82	19·5	12·6	13·6	14
Myopia, Myopic or Mixed Astigmatism ...	16	29	19	19	20	25	13	11	12	64	64	36	10·6	10·6	6	32·6
Convergent Squint ...	5	9	8	12	10	4	6	4	5	22	26	15	3·6	4·3	2·5	2
Inflammation of Eyelids or Conjunctiva, including Phlyctenular Ophthalmia ...	19	13	10	8	13	10	18	9	21	42	31	48	7	5·1	8	10
Corneal Opacities ...	7	4	1	4	10	7	...	1	2	12	21	3	2	3·5	0·5	2
Number Examined ...	197	204	200	199	201	200	200	200	200	600	600	600	...	...	...	...

Table III.

Table IV.

Highest class in each school.

School.	Milton.	St. James'	Gorbals (Christians).	Gorbals (Jews).
V = $\frac{6}{6}$ or $\frac{6}{5}$	30 or 75 p.c.	40 or 72·8 p.c.	44 or 78·3 p.c.	19 or 58·3 p.c.
V = $\frac{6}{12}$	3 or 7·5 „	7 or 12·7 „	5 or 9 „	4 or 12 „
V = $\frac{6}{18}$ or less	7 or 17·5 „	8 or 14·5 „	7 or 12·7 „	10 or 30·3 „
* Hypermetropia or Hypermetropic Astigmatism.	8 or 20 „	8 or 14·5 „	7 or 12·7 „	4 or 12 „
* Myopia, Myopic Astigmatism, or mixed Astigmatism	2 or 5 „	7 or 12·7 „	5 or 9 „	10 or 30·3 „
Wearing glasses	2 or 5 „	2 or 3·6 „	2 or 3·5 „	0
Number examined	40	55	56	33

* *Only those with* V = $\frac{6}{12}$ *or less had their refraction estimated.*

Table V.

School	Milton.		St. James'		Gorbals (Christians).		Overnewton.		Gorbals (Jews).		Total.	
Sex	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
V = $\frac{6}{6}$ or $\frac{6}{5}$	51	48	55	54	56	46	61	46	44	32	267	226
V = $\frac{6}{12}$	9	13	10	7	7	13	6	14	7	15	39	62
V = $\frac{6}{18}$ or less	14	15	14	11	12	16	8	15	24	28	72	85
Emetropia or Low Hypermetropia	40	35	36	38	41	27	44	36	30	22	191	158
Hypermetropia of 2 dioptres or more	14	16	24	13	12	15	13	14	14	14	77	69
Hypermetropic Astigmatism.	16	14	9	15	16	21	13	13	12	9	66	72
Myopia or Myopic, or mixed Astigmatism	4	9	10	6	6	12	5	12	19	30	49	69

TABLE VI.

Visual acuteness of one eye normal, the other defective.

		Milton.	St. James'	Gorbals (Christians)	Gorbals (Jews)	Over-newton.	Total.	Per centage.
Vision of defective eye.	V = $\frac{6}{12}$	5	10	3	3	6	27	3·6
	V = $\frac{6}{18}$ or less ...	7	6	8	5	3	29	3·8
Defective vision due to	Corneal scar.....	4	1	1	...	...	6	0·8
	Myopia...	4	2	3	2	2	13	1·7
	Hypermetropia...	4	13	7	6	7	37	5
	TOTAL	12	16	11	8	9	56	7·5

[*This Discussion applies also to the Papers by* MR. E. W. BRABROOK, DR. A. K. CHALMERS, DR. THOMAS KAY, DR. ALEXANDER H. EDWARDS, *and* DR. H. WRIGHT THOMSON.]

COUNCILLOR BURGESS (Glasgow) said that in the statistics given by Dr. Chalmers there was a most significant change from the statistics which the Doctor had given as recently as the year 1901. In that year Dr. Chalmers analysed the death-rate in the one-apartment houses of Glasgow, and gave that death-rate as 33 per 1,000. Now that figure had not changed in the recent investigation into Glasgow housing conditions which had been completed within the last few weeks. In 1901 in the two-apartment houses the death-rate was over 22 per 1,000, and that had now been reduced to 21 per 1,000; in the three-apartment houses the death-rate in 1901 had been given at 13 per 1,000, and it remained now at 13 per 1,000. Yet in the meantime the average death-rate of Glasgow had been reduced from over 20 per 1,000 to 18·4 per 1,000, so that while there had been a general reduction in the death-rate of the city, which had shown itself in the recent investigation to be in the two-apartment houses, there had been absolutely no reduction in the one-apartment houses. They had had given to them a new theory that morning. So far as he was able to judge there appeared to be a disinclination on the part of the municipal representatives to put their finger upon the points with which they had authority and power to deal, and an inclination to wander in search of some other explanation which they could not influence at all. Now, in the Municipal

Section on the previous day they had had a defence of the one-apartment house from the convener of the Glasgow Public Health Committee, and an impatient oration from a characteristic Scotchman who seemed to think that the national honour was somehow bound up with the maintenance of this type of house. The theory advanced was that the explanation of the alarming difference between the one, two, three, and four-apartment houses was not due to the faults of the house, but to the faults of the persons who inhabited the house. In this connection, therefore, he wanted to touch upon one or two of the new theories which had been advanced by Dr. Chalmers that morning. He held that they could not indict one system of dwelling, which housed 104,000 people of Glasgow, with uncleanliness; they might as well try to indict the nation. No doubt among the one-apartment population they would find some very dirty people, and they would also find some very clean people. The same thing would happen with the two-apartment houses. The difference of 12 per 1,000 per annum in the death-rates of the two classes of dwelling could not be accounted for on the ground that the one class were dirtier than the other, because there were dirty people in both. They had had that morning a one-apartment clothing standard, and a one-apartment feeding standard. He would, therefore, like to have, if possible, some definite scientific opinion as to whether there was any absolute case of death of children in that city to be traced to starvation. Could the high death-rate in the one-apartment houses be traced to want of nutrition of the children. He contended that the municipal authorities had a standard of what housing should be, and they could leave the question of the feeding of the children to the School Boards. It would, however, be interesting to know whether any direct connection could be traced between the physical condition of the children and their food. If so, he thought it was the duty of the educational authorities to carefully consider whether they were doing all their duty to the rising generation in attempting to teach badly nourished children.

Dr. A. Newsholme (Brighton) said that by the collection of accurate facts of this kind we should really be able to get at the bottom of some of our social evils, and thus be able to secure improvement. That was probably the point which Councillor Burgess had in view, but he was certain that we can best get at these facts through the school. One of the lessons they might learn from these investigations was the desirability of having medical inspection in connection with our schools, and of having in the large schools a record made by the teacher of the heights and weights of the scholars, at least once every quarter, in order that they might know the progressive state of the child from that point of view. They would in this way gradually collect a mass of statistics which would enable them to ascertain how the children were being treated at home, whether they had sufficient food, or were being neglected by their parents, and in that way bring pressure to bear on the parents to do

their duty by their children. He pointed out how important it is that we should not suppose any one particular source of evil is responsible. It was not a question only of feeding, clothing, and dirt, but also a question of morals. People living in one room have one-room morals, and those living in two rooms have two-room morals, and were generally better than the people in the one room, and so they had in forming conclusions to look at things all round, and not merely take them as a question of one room only or any other special condition. But he was certain that so far as the children are concerned the important item is that of food. They must insist as reformers upon the parents who spend their money in alcohol doing their duty by the children for whom they were responsible for bringing into the world. If they could get from that section of the Congress some resolution expressing the opinion that a medical record should be kept in every school of the height and weight of all children periodically, say at least once in three months, or if that was not possible, once in six months, a very good result would follow that discussion.

Councillor Smith (Birmingham), speaking as a teacher in a large school, observed that it had been very nicely put that morning that certain things ought to be done, but the question to his mind was as to who should do them. If it was to be the teacher who was to do these extra duties, he would point out that there was such a person as H.M. Inspector, upon whose report rested the money with which the school was carried on. Already school teachers had innumerable forms to fill up, and this clerical work took up a large portion of their time which really ought to be devoted to teaching, which was the teacher's proper work after all. The result was that teachers were now a kind of clerk, and if they were going to be asked to do more form-filling, of course they would not refuse to do it, if there was to be this quarterly examination of each individual child, all he would ask was when was the teacher going to teach? Already teachers were required to be walking encyclopedias and public libraries, and to add to their burdens was not desirable in educational interests. He thought the opinion should go from that Congress that the duty of examining the school should be placed on the man who had been trained specially for that work and made a special life's study of the subject, and that it ought not to be put on the poor schoolmaster or schoolmistress.

Mrs. Martin (Dundee School Board) said she had been much interested in the remarks of Dr. Chalmers, as to the nature of the results of the enquiry into the feeding of the children, as she was one of those who believed that very often the ill-feeding of the children was not so much the result of poverty, as the outcome of ignorance and carelessness on the part of mothers, who knew nothing whatever regarding the nature of food combinations essential to the building up of the tissues of the body. She therefore felt that the first duty of School Board authorities in regard to this vital question of feeding was not to

do what is easiest with many people, put the feeding of the children on the rates, but to endeavour to teach the girls who will be the future mothers as to what constitutes proper feeding for children. In former years large numbers of girls left school at the early age of 11. Before that age cooking was not taught. Now, however, that the school age has been raised to 14, there was a chance of giving them a knowledge of the duties that lay before them in after life. With regard to the feeding of the children by the Board Schools or voluntary agencies, she advocated the system of contribution from the parents. In Dundee they had an experiment of dinners through the winter months, the teachers being able to provide food for 2d. a week. Children contributing that amount per week received daily a bowl or bowls of soup, and although some of the districts were very poor indeed, the teachers had stated they had not any difficulty in securing the money. But in cases where the teacher was convinced that there was real genuine poverty, there was a discretionary power to provide the children with food, any deficiency caused in this way being met by public subscription. There was much laxity in dealing with public funds, and she had a great objection to and suspicion of the feeding of children being put on the rates. There was nearly always sufficient philanthropic effort outside to co-operate with the school authorities in securing the supply of the necessary food, and this arrangement should meet all the difficulty. But, after all, the essential thing was to teach fathers and mothers that right food combinations are not necessarily expensive foods. Knowledge was required for true economy; an educated woman keeping house would be more economical than a woman in the slums. On these lines, then, domestic training should be thoroughly taught in our schools. Dr. Noel Paton had said, with regard to the expenditure of wages in Edinburgh, that if we could get hold of the women and show them the things that they ought to purchase, there would be less outcry with regard to the results on the children.

Councillor H. Miller (Glasgow), referring to Dr. Chalmers' statistics with regard to the examination of school children in Glasgow, said that the subject was of importance, because, while a great deal was heard about Britain's first line of defence being the Navy, after all our real line of defence was the national physique, and especially the preservation of the teeth. Some speakers had made a great deal with regard to proper feeding, but while food might be prepared in the most scientific manner, unless our grinders were in a state fit to prepare the food for the processes of digestion, he was afraid all our cooking science would go for naught. Another point in connection with this subject, was the production of mental fatigue by dental decay; if the children were in pain with their teeth, it was not at all surprising that they were unable to absorb knowledge. It therefore seemed to him that some organised effort should be made in the direction of getting the children to take more care of their teeth. According to the tables given them, in two schools in Glasgow there were no

children who brushed their teeth daily or took any care of them whatever. The percentage of Jewish children rose to 12·5, and with the Jewish children the percentage of decayed teeth was less than in the other classes of children. This was a significant fact which might have an important bearing. While this particular matter appeared to be of so much consequence, it received very little attention from the teaching profession or from the public at large. In other countries, and to a small extent in our own, efforts had been made to remedy this by appointing school dentists, while in America a good deal had been done towards inducing the State to provide dental service for those parents who were unable to provide it themselves. While that might be somewhat advanced for this country, he thought some effort should be made to point out to the children the importance of preserving their teeth, because on the efficient work of the teeth depends to a very great extent the health of the children, and their capacity to receive instruction with profit.

Dr. Leslie Mackenzie (Edinburgh) said that in Dr. Kerr's report a year ago would be found the results of an investigation of the eyes of some 30,000 children, and a comparison given of the results found by the teachers' examination and the results found by the exhaustive oculist's examination. That tabulation clearly indicated that the work of the teacher was of primary value in the classification of the children with defective vision, and going to simplify the work of the medical inspector. Since this question had first been discussed a great number of people had asked, "What are you going to do when you have found defective children?" That was not primarily a question for the medical inspector; it was for him to find out what are the facts. They were not prepared to say what the organisation of this movement might be, but he thought that when they had got the actually established facts they would find that the ordinary administration of the public health and the School Boards themselves would be compelled not to leave these children alone, but endeavour to see how this material could be made the most of. But going amongst children and looking at them, there was no doubt that thousands of them were systematically underfed; that fact was beyond question. Then in regard to the question of the cleanliness of children, this was a condition not to be associated with any particular kind of house or number of rooms, but the main fact was that shoals of children come dirty to school. In one infant department that he had had the privilege of seeing in more or less detail, he should have said that two-thirds of the children, certainly half, were in such a loathsome condition that he would not have sat beside them himself in school, or allowed anyone else to do so. These were the facts, and they could be explained as one chose. Incidentally he might mention that in an investigation organised since the previous Edinburgh investigation, one result was that within forty-eight hours of the beginning of the school inspection, child after child came with clean shirt, or had been specially bathed for the purpose of inspection. The

word had gone round that the children were to be inspected, and a good many of them had fathers and mothers who had got clean clothing for them, though where the money came from he did not know; the fact remained, these were clean children and had clean clothing.

Dr. James Kerr (Education Committee L.C.C.) said that without going into the details of all the things that Dr. Chalmers had put before them of the excellent work which had been done, he thought that before long they would be looking to Glasgow for many more results and many theoretical explanations, which only a close study of the Scotch methods would be able to lead them to. But at the same time he thought that the whole question of school hygiene could not be taken as a compartment by itself, and that they could not lay it down that this belonged to school hygiene, and that to another department and nothing else. Once they began to study their eyes, or their infirmities, or their cleanliness, it was found that the roots of these questions extend far beyond the school, and when once they endeavoured to do anything with those conditions their measures would have to extend beyond the school. The simple matter of cleanliness, any one might say, was a very easy thing to deal with—to get the children clean at school. But it was not so. They had been trying to secure this in London; but it was astonishing in London how much personal hygiene in the children is neglected. No doubt in the Glasgow schools the girls' hair was in a bad condition, and they would also find homes in a filthy condition, and if they came to discuss the one-room tenement or the three-room tenement, they would find that the children living in the one-room tenement were more liable to infection than the children living in the three-room tenement. So that in that way they might get a class of disease associated with the one class of house, and not with another class of house. There was no doubt the one-room tenement disseminates disease, and yet when they began to look into the question of the one-room tenement they would find there were lower depths still. For a considerable number of years he had been through the girls' schools in Bradford, dealing with the growth of the children, and there they found it was no good taking the one-room tenement, they had to take the number of beds in the room; they found it was a case of one family one room, two families one room, or three families one room even. These were figures that went beyond the one-room tenement question altogether. But no doubt when once they began investigating the school question, they would have to influence the home through the school, and they could only influence the home and the school by getting hold of the teachers. The great pressing question in almost all matters of school hygiene, was the teaching of the teacher. With the present generation of teachers we could only look to do the best we can, but the future generation of children and teachers had to be regarded. We must see, too, if they could not even go beyond the teaching of the teacher, because we want the teaching of

the inspectors also. The Board of Education itself also wanted educating. But when they had considered all the ramifications dependent on these points, there was no doubt at all that at the root of the whole national life and of school hygiene was the housing question; and then when they had reached the housing question there were still further depths, such as the land question.

Mr. J. Cameron (Montrose School Board) said the Montrose School Board believed in largely teaching the people how to help themselves. They had instituted meals for the children, and in those cases where the parents were really unable to pay the twopence charged for a meal the money was obtained from outside sources, because they did not believe in tampering with public funds or in putting themselves on the rates. That would be a wrong step, because it was most desirable to maintain the spirit of independence in the parents and young people. With regard to the alleged starvation question, he had been much impressed upon one occasion by four or five boys at the table, who were eating their food in a very lackadaisical style, and he had found these were notorious smokers of cigars. Inquiry showed that a number of children were really unable to take proper food through the habit of smoking. In these cases it was desirable for the teachers to go to the parents and give them the information, because the children were practically starving themselves. Not only was it necessary to look into the question of meals in the home, but it was desirable to see that the food given the children is nourishing and the best that they could have. To teach improperly fed boys and girls drill and physical exercises was in his opinion decidedly wrong, in fact, it was a kind of cruelty.

Alderman T. P. Griffiths (Southport) observed that Dr. Newsholme had struck the note that appeared to be the practical one. If Dr. Newsholme would like to propose a resolution in regard to the medical inspection of schools, a periodical inspection (whether quarterly, half yearly, or yearly, did not so much matter as the affirmation of the principle), he would be delighted to second it. He thought it was time they tried to obtain the co-operation of all the local authorities with the teachers and with educationalists in order to bring the education of the children up to the very highest possible standard. He therefore hoped they would have some practical resolution in regard to the medical inspection of schools, because all the representations they had had that day pointed to its being of the highest importance. They had heard from Dr. Kerr, of London, of the many difficulties in connection with the scholars, and those difficulties must be bravely faced, and by the educational authorities. He believed that the authorities of the town he represented would be quite prepared to face these difficulties, and if children were found with defective vision,

defective teeth, or were defective in other ways, they would do their best to meet those defects and provide some special accommodation. No doubt the first duty in these matters lay with the parents, but if the parents were unable to discharge this duty, then it became a public duty.

Lady Griselda Cheape (Glasgow) urged the importance of one point which had not been touched upon that morning, the teaching of the boys and girls the duty of thrift. In Scotland this had always been a famous national characteristic of those who had gone before. There was too much self-indulgence nowadays. If the people could be taught to spend their money wisely and well, and to be thrifty, the result would be that the children would be brought up better and healthier.

Bailie Dr. E. W. S. Stevenson (Glasgow) said the great thing was to get the people interested in these matters themselves. For instance, cookery classes had been established throughout the town, and the women were being taught how to cook cheap food, what to buy, and how to make little tasty meals. These classes were carried on for two sessions, but he was sorry to say the interest in the instruction gradually disappeared. In speaking to the women it had been found there was a disinclination to cook. The point of the whole thing was that there was a lack of interest on the part of the mothers in their children, they did not care about them, and seemed only to like lolling about the house. Even in the middle of the day some of the houses would be in a disgraceful condition. It was necessary to get hold of these women, and show them that their duty was to care for their children and their homes.

Mrs. Mackenzie (Glasgow) said that one point with regard to the failure of cookery classes in schools, and industrial centres, and homes for girls was that it is done on a too magnificent scale. All sorts of things were used, and when the learners went home, probably all they would have to cook with would be a couple of plates, a couple of iron bars, and a frying-pan. They could not put what they had learnt to any practical use, and this suggested that under these circumstances the kind of teaching given in cookery classes was a mistake.

Miss Fisk, speaking from the teachers' standpoint, said there was a great deal to be said in favour of a medical examination of school children, but she did not think it was right to suggest that all these things should be left to the teacher. One of the speakers had suggested that all teachers are not engaged in teaching at present, and that something might make way for these new duties. From practical experience, she could not see what things were to make way. The teacher had all these things settled for them; they had no choice in the matter. Amid this cry of the care of the children the teacher was being entirely neglected. Every fresh burden made the teachers' life still more

difficult. Nothing was being done to improve the health of the teachers, the children were having most consideration; all that was being done was to provide for a nervous break-down on the part of those who taught and superintended the children. There seemed to be an idea that there was no hope of the present day teacher doing much for the good of the children; but as a matter of fact the teachers did a very great deal in many ways for the children already, and in looking after their health; far more in fact than the general public was in the habit of supposing. Innumerable letters were sent home to the parents, calling attention to defects of the eye-sight.

The President (Prof. John Edgar) expressed his sympathy with Miss Fisk and her views, still at the same time he desired to extend the functions of the teachers, and to make them more intense. He would certainly object to add to their burden of work; anything that implied extended work on the part of the teacher must be understood to imply an increase of staff. The limitation of the hours of work was a most necessary thing for many teachers.

Mr. W. J. Abel (Clerk to the Nottingham Education Committee) said he thought if they were going to do anything at all effective there must be a collection of facts and figures. The teacher would have not only to be educated for the work, but also given time in which to do it.

The President said it was not possible to put a formal resolution from the chair, but he had no objection to taking the general feeling of the Conference on the subject of medical inspection of school children, and as to whether a regular examination of some kind was desirable. He would put it to the meeting as follows:—"That it is the opinion of the meeting that there should be regular and systematic medical inspection of school children, and request that the Council of The Sanitary Institute will bring this important matter before the educational authorities of the country."

This recommendation was carried.

MUSCLE AND MORALITY.

By J. G. LEGGE.

THERE was never a time when the physical well-being of the nation was more in people's minds than the present. History is full of instances where the effect of a great war has been to produce a crisis in the countries involved, to set people thinking deeply not so much of success as of failure, suffering, or disease, and to devise remedies for defects in the body politic which have been brought to light. We are still digesting the lessons of the South African War. Prominent has become the care of school children. People are feeling that it is not enough to consider merely their intellectual training, or even their moral training; an effort must be made to safeguard health and improve physique. The study of the problem has opened people's eyes to the painful difference in the physique of children according to their class in society. The children of the well-to-do are bigger, stouter, and healthier far than the children of the poor. The conscience of the community is stirred, and we are anxious to do what we can to redress the balance. A great impetus to reform was given by the Report of the Royal Commission on Physical Training in Scotland, and the allegations which have been spread broadcast as to the physical deterioration of our race have led to the appointment of a Departmental Committee to consider and report upon them. That Committee's Report will be issued before long, and may be expected to back up the Report of the Scottish Royal Commission.

Now it would be a great mistake to suppose that the present agitation for a physical as well as an intellectual training of our children is a new thing. In savage communities, where something obtains approaching to the philosopher's state of nature, the one is bound up with the other. Even in such a civilised community as that of the Boers in South Africa the two have hardly been differentiated. The active, open-air life led by the young Boer from childhood has been more than the equivalent of the most elaborate system of free or applied gymnastics that can be devised to meet conditions in a thickly populated island like ours.

As soon as city life began, the need was found to organise what may be called artificial substitutes for the natural exercise essential to the support of life in primitive days. Simple illustrations that will occur to everyone

at once are the insistence on physical training to be found in the writings of ancient Greeks, such as Plato, and the important part played by the gymnasium and athletic sports in all ancient societies. In Plato, too, will be found a clear and emphatic recognition of the curious inter-relation between bodily well-being, mental sanity, and moral excellence. But we need not go as far back as Plato. It is most interesting to any student of the science of education to find that in the middle ages, physical training held a foremost place in almost all systems of education; though we must not forget that the mediæval scheme was bound in the nature of things to attach prime importance to the training of the body, for in those days, as in primitive times, a man was often called upon to fight for his existence, and to a gentleman above all was it necessary that he should be able to hold his own on horseback and with sword or lance. Odd to any inhabitant of this island in those days would appear the modern prejudice in some quarters against military training.

Now I think we ought to draw a very clear distinction between those who oppose military training, and those who oppose physical training for fear that it may encourage a military spirit. The former are entitled to respect; but with the latter I shall hold no dealings at all, for I honestly believe that an individual who cannot draw a distinction between military drill and physical training, and who believes that physical fitness implies pugnacity, is as much outside the pale of reasonable humanity as the man who argues that the earth is flat, or that the sun moves round the earth. To those who believe that physical training is not a thing in itself to be discouraged, even if a certain amount of military training is superadded, considerable comfort will be afforded by an appeal to perhaps the greatest writer of English verse or prose that ever lived, and a Puritan of Puritans: John Milton. In his famous tract on Education occur the following passages. His definition of education is as follows:—

> "I call therefore a complete and generous Education, that which fits a man to perform justly, skilfully, and magnanimously all the offices, both private and public, of Peace and War."

With regard to physical training he says:—

> "Therefore about an hour and a half ere they eat at noon should be allow'd them for exercise, and due rest afterwards: but the time for this may be enlarged at pleasure, according as thir rising in the morning shall be early. The exercise which I commend first is the exact use of thir Weapon, to guard and to strike safely with edge or point; this will keep them healthy, nimble, strong, and well in breath, is also the likeliest means to make them grow large and tall, and to inspire them with a gallant and fearless Courage, which being temper'd with seasonable Lectures and Precepts to them of true Fortitude and Patience, will turn into a native and heroic Valour, and make them hate the cowardice of doing wrong."

How better could the intimate connection between Muscle and Morality be phrased than in that last superb sentence of John Milton's? But these quotations lead me to call attention to one marked advance in the consideration of physical training since ancient and mediæval days. The main concern of the past was to make fine men physically of the gentle classes of the community, while the *proletariat* has had to fend for itself; and this feeling has survived even in such a mind as that of Milton. There were writers on education in the sixteenth and seventeenth centuries who were dimly conscious that the masses of the population required just as much careful attention as any selected class, but this is all our burden to-day: certain selected classes are well enough provided for, and what we have got to do is devote our energies to the amelioration of the masses.

I think I can best strengthen my appeal for physical training as an agent in promoting morality, by giving some account of my experience of its operation in the schools with which I am specially concerned, the reformatory and industrial schools of Great Britain.

To these schools are sent a considerable number of children who may roughly be divided into three classes:—

1. Children who though innocent of any actual offence themselves are the children of criminal parents or parents on the brink of criminality.

2. Children who persistently play truant from school and whose vagrant habits render it likely that they will gradually drift into criminal habits.

3. Children who have actually themselves committed some offence against the law of the land.

It is now just about 50 years since the Government of this country clearly recognised by legislation that the duty of society towards the juvenile delinquent was not punishment, but correction, and correction in the proper sense of the term, by means other than that of the rod. It is true that the bulk of the children so sent to these schools are on admission backward mentally, stunted physically, and warped morally. That this should be the case is not surprising, for all the three classes of children that I have tried to differentiate above can be combined under one great head, neglected children. But it would be a mistake to suppose that these schools are full of nothing else but half-starved, stunted, defective, vicious children. Such among them there are, no doubt, but side by side with these is the very cream of the juvenile population of the country: the little boys who have actually stolen the apple or broken the window while other boys looked on; the young Rob Roys of city life. No one who has much to do with these children but must recognise that the very qualities which have got many of them, indeed most of them, into trouble

are fine qualities to be admired in a boy. What they want is proper direction.

It would be idle in this brief paper to attempt a definition of the term reformation; as hopeless a task as an attempt to define the term gentleman. But what I can claim for reformatory and industrial schools of Great Britain is that they have proved two things: first, that the earliest glimmer of reformation in the inmate of a reformatory school is detected when he is found to have developed a feeling of self-respect; secondly, that this feeling of self-respect is easiest aroused by inducing a boy to take a pride in his physical development. A superintendent of long experience once informed me that the moment he detected a boy feeling his biceps he considered that the boy was trustworthy. He was right in nine cases out of ten. Once a boy has begun to take an interest in physical drill, in gymnastics, free and applied, in running, jumping, and healthy field sports, not only does he begin to exercise self-restraint and to avoid temptations which he knows may impair his bodily fitness, but his mind is stored with interests more wholesome than those which excited his curiosity or inflamed his cupidity in his unregenerate days. Furthermore, to take the physiological point of view, the rigorous discipline of the body in youth undoubtedly absorbs or dissipates certain humours of the body which are fostered by a confined, sedentary, crowded city life, and which, if allowed to get the mastery, will not only injure the body, but stimulate the brain to a noisome activity and poison the very wells of morality. To me religion has always seemed to imply the care of the body and the mind as well as that of the soul, and I honestly do not believe that in many a case admitted to a reformatory school have the finer spiritual elements of religion any influence whatever until the body has been disciplined, the mind scoured, and some basis of morality thus established. For this view I can claim high ecclesiastical authority. I was present once at the opening of a gymnasium in connection with a working boys' home by a certain Archbishop. His Grace declared that in opening that gymnasium he was performing a service akin to one that fell more frequently to his lot, viz., the consecration of a new church.

When I first went round the reformatory and industrial schools of the country some ten years ago, I was most powerfully impressed with the difference in the appearance and manner of boys or girls in a school where physical training had its proper place as compared with the inmates of institutions where it had not. More delightful specimens of British boyhood it would be hard to discover than in the former. Firm flesh, straight bodies, heads erect, hale complexions, frank and open countenances, straight, clear, intelligent eyes and a ready smile; these characteristics

were found nearly always to imply in the doctor's book an almost clean sheet, and in the record of offences little absconding, few offences against morality, next to no bullying, only an occasional case of pilfering or lying little, indeed, but what is bound to occur and has to be reckoned with when high spirits explode. As physical training has improved throughout the whole system of schools during the past ten years this happy state of things has become common, and there is no reason, save the miserable limitations of human endeavour, why it should not be universal. About eight years ago I had a hot argument with one of the superintendents of reformatory schools whom I most respect with regard to this question of physical training. I remarked to him that, though I considered there were fine points in his school, not nearly enough attention was being paid to physical training and to healthy field sports, and that were these attacked in earnest the reward would be reaped in a marked diminution of cases of absconding, and in a too long list of offences of various kinds. On that occasion my friend argued against me. He said the boys were not sent to his school to play, and it was their souls and not their bodies that were the main concern. However, in that school physical training had gone ahead, and when I visited it two years ago and was walking round the farm, I was congratulating my friend on the extraordinary decrease in his percentage of reconvictions of recent years, and on the fact that his health seemed better than I had ever known it, so that talk of resignation through advancing age and failing health, which was a topic in which he used to indulge some years earlier, seemed quite forgotten. He smiled and reminded me of our old conversation. He confessed that on that occasion he had been wrong. He had made up his mind to give what he called these new-fangled ideas a trial, and being an honest man he gave them a fair trial, and the result had surprised him. He wound up by saying that six years earlier the management of this school was a continual anxiety, now it was no trouble at all, the place ran itself.

Though I have dealt in this paper mainly with physical training as it affects the inmates of the special schools with which I am particularly acquainted, and though I admit that its effects are perhaps more readily noticeable in them, yet I think that for all children in the country the subject is of like importance. As regards schools for the richer classes of society, there is no need to preach the gospel of muscular Christianity, to use a fine old phrase; in some of them, sports and games are even overdone; but in the public or elementary schools of the country there is not the slightest chance of excess in physical training, or in organised games. It will take years of enthusiastic hard work before we even

approximate to a proper state of things. It may be suggested that we have now got about enough libraries in our towns, that we want gymnasia and properly equipped recreation grounds, and that librarians may well be supplemented by gymnastic instructors.

I have dealt in this paper liberally in quotations, for I hold that when a true thing has once been well said it cannot be repeated too often. I should like to conclude by a quotation from a French writer, Nicole, who lived in the early part of the 17th century. He wrote a book entitled "Views on the Right Upbringing of a Prince." Nothing better can be suggested to sum up my brief paper, than was said by this Frenchman some three hundred years ago, though, as I have pointed out earlier, we may flatter ourselves that what in the past even reformers claimed only for princes and gentlemen, we desire to-day for the people.

> "Not only must we form the minds of our pupils to virtue, we must also bend their bodies to it, that is, we must endeavour that the body do not prove a hindrance to their leading a well regulated life, or draw them by its weight to any disorder. For we should know that as men are made up of mind and body, a wrong turn given to the body in youth is often in after life a great hindrance to piety."

Mr. W. H. Addison (Superintendent of the Glasgow School for Deaf and Dumb) said, as a teacher of long experience and one not connected with the ordinary class of children, but with children of an abnormal type, he desired to strongly support the position taken up by Mr. Legge, in regard to introducing physical training of all kinds into our schools. It had been with him a fundamental axiom for many years that true education must begin with the physical side of the child. He believed that almost in every case it was impossible for the mind to do its full work unless the bodily system is in perfect health, and at its fullest point of vigour. For this reason it behoved the teachers of every class of children, as far as possible, to secure that the children under their control are in a good physical condition. Especially from the higher point of view was this to be regarded, from the point of view of spiritual and moral development. All children, and boys especially, were most easily influenced through their games, through things in which they were most likely to take an interest. His experience was, that things which interest children begin with their games. Those teachers succeeded best, from the moral point of view as well as from other points of view, who interest themselves thoroughly in the children's games out of school. The best results were obtained, from all points of view, by those teachers really interested in the subjects which they had to teach. If they took a particular scheme and gave it to all schools alike, irrespective of the special circumstances of each case, they would probably do more harm than good. The point that should be regarded as of importance was that the teachers should be encouraged to take an interest in the games of their

pupils, in the physical drill of their pupils, but there should be left to them some discretion as to the kind of drill or training which could best be given to the children under them. For instance, the result of a long experience of all kinds of games and drill (he had always been fond of athletics) was that football and cricket are the best physical training that can be given. These games, properly supervised and properly carried out, are better for growing boys, and games such as hockey are better for girls, than even the gymnastic training in the schools. Swimming, too, was excellent exercise, and although circumstances did not always permit of this pastime being indulged in, its value should be recognised. But he specially wished to impress upon the Conference the importance of the teacher being allowed some choice in the matter. The influence gained by the teacher in this way lasted often through life, and that influence could only be obtained by teachers taking an interest in the games of their scholars.

Dr. A. K. Chalmers (Glasgow), observed as they were all interested in physical drill he would like to ask the members of School Boards present if they thought it sufficient to give a child an hour a week dumb-bell exercise or breathing movement. Could they reasonably expect that that would do anything towards advancing their physical condition. His complaint in the matter of systematic physical exercise for the children was that it was far too limited, and great benefit would result if they could be got to follow up at home the exercises started at school. But they had to rely very largely upon the time spent on physical exercise in school as the only time so spent. Mr. Addison had referred to swimming, and that was a form of exercise which combined so many excellent features, in fact it embraced the good points of nearly all the others, that if they had swimming baths more largely provided in their Board Schools, they might have a fair expectation of finding the children benefit in a way out of all proportion to what they would do by effort in other directions. It was the testimony of medical men examining for life assurance that when they examined a man well developed physically, and well proportioned, the chances were that he was in the habit of taking swimming exercises, not, of course, long distance swimming or race swimming, but simply as exercise.

Dr. T. Simpson (Waterloo-with-Seaforth), said that in Liverpool, to which city he belonged, Mr. Samuel Smith, M.P., had given an immense building for a gymnasium in connection with the Young Men's Christian Association. Since the inauguration of that institution and the development of its functions it had been carefully noted that the morals of the young men (who had availed themselves of that gymnasium for nightly instruction and practical gymnastic exercises) had improved and grown healthier, so that it had been the subject of comment in other cities besides Liverpool, notably in London. He had heard eminent surgeons emphatically express the view that the observance of physical education was a means of elevating the mental powers and moral

attainments. This might well have been a lesson from the Olympic games practised in Greece in the early days of the history of the world. He hoped that the relationship of physical education and intellectual education with moral advance, would in the future be more generally recognised, and efforts made to take advantage of that relationship.

Lady Griselda Cheape (Glasgow) suggested that a simple way of furthering what they had in view would be to arrange for the children, when they leave school, to be marched out. This would teach them deportment and give them confidence in leaving and entering a room properly.

Mr. W. Graham (Glasgow School Board) agreed that a system of marching in and out of school three times a day would result in an improvement in the manners of the children. This would be a good thing for the schools in that it would tend to counteract the influences of the streets.

The President (Prof. Edgar) said it would be valuable to have some expression of opinion as to how the various forms of drill or games affect the condition of a boy's mind and body in regard to human passions. Could any expert say, for example, what the outcome of football would be on a growing youth? Did games really have a purifying moral effect? For himself, he knew that in the old days High school boys would meet the town boys in combat, and before the competition in games was established, regular and serious fights would take place. No doubt football and cricket had entirely done away with these pastimes. This was one instance of how the spirit of fighting had been transformed by athletic games into a wholesome form of competition, very healthy in its effects. In the same way, just at the time of puberty, teachers of both sexes knew what an extremely difficult thing it was to deal with boys and girls from 14 or 15 up to 18 years of age. This was, in fact, the great difficulty of the teacher. Could any expert give any guidance as to the kind of game which it was wisest to encourage and which would act best as a purifier of the senses, an outlet in natural ways for feeling, and a natural stimulus of the growing life? Recently he had been much struck with hearing that in one of the best schools, immediately after the mid-day meal, the heaviest meal of the day, the boys were compelled to go out for a considerable run of a couple of miles. That was quite contrary to what was usually supposed to be the proper thing after a heavy meal. The meaning of this practice he shrewdly suspected was that it was desirable to provide some counteraction at a critical time of life to these boys. He would like to have the views of others on this point, because the modern method of dealing with the body was not the ancient one of absolutely mortifying the flesh, and weakening it, but of transforming it with moral and intellectual ideas. After all, looking at it from the physical side, morality is based on the will. In learning to contract our muscles or not to contract our muscles at will, there was the learning of control and inhibition, and this was brought about by our various games. They could imagine,

therefore, how complete the control of the body could be made, and how the mental could obtain a mastery over the physical.

Mr. J. CAMERON (Montrose School Board), as an old teacher in a Board School, cordially supported what had been said by the President. He had always found that where boys had a disinclination for manly games there was invariably something seriously wrong. Other men had testified to the same effect. Games and athletics were healthy counteractors of vice in any form, and if the boys could be got to take a thorough interest in their manly games the results would be excellent. He sympathised much with what Mr. Addison had said in regard to cricket and football, which were the only two games he had been able to throw himself enthusiastically into, and he had no difficulty in getting the boys to join him. Sometimes he had been accused of cultivating too much love of physical exercise on the part of the boys, but he did claim that, while being ambitious for the success of the school and the success of the team, he was also training their moral courage, stimulating them to take a deeper interest in what would be for their ultimate good, giving them a manly form and condition of mind, stimulating their sympathies aright, and fitting them to discharge ordinary daily duties. He had heard in the case of young girls in shops that now, in addition to receiving religious lessons, they were encouraged to take part in gymnastic exercises. In one case a lady superintendent had told him that by the introduction of gymnastic exercises the habit of tight-lacing was destroyed. In this way the young girls were deriving benefits of growing into a proper physical condition and fit to discharge their duties in after life. A great deal would be needed of the mothers of the future generation, and all such efforts as these were to be commended.

ALDERMAN WHERRY (Bourne, Lincs.) said that one point of Dr. Legge's paper had not received sufficient attention, and that was the effect of physical training in reforming the tastes of the lads sent to reformatories. In one particular case which had come before him as a magistrate, it had been his duty to send a lad of almost hopeless character to the reformatory. The town was glad to get rid of him. He had written specially to the superintendent of the institution, and suggested that the boy should receive encouragement to a better life, and being a very lively little fellow he might expend some of his energy in the gymnasium. That boy by this means had been reformed, was a prize winner in almost all the competitions, in the second year became quite amenable to discipline, and was now leading an honourable and respectable life. Not only so, but physical training had been the path that led to a religious character and life. They could not, therefore, judging from this interesting illustration, lay too much stress upon the outline given in Dr. Legge's paper of the means of ridding society of some of the worst characters by the physical training that he had described.

DR. H. DYER (Glasgow School Board) also took part in the discussion.

RESPONSIBILITIES OF MUNICIPAL AUTHORITIES & COUNTY COUNCILS WITH REGARD TO THE DEVELOPMENT OF SCHOOL SANITATION.

By Miss EDITH MARY EVANS.

(Associate.)

THE Education Act of 1902 is gradually developing and showing the form which the alterations will take, throwing certain points into shade, casting high lights upon others, and is certainly bringing the subject of hygiene of schools and scholars into the foreground of the picture.

Degeneration.—Public opinion throws a strong light occasionally on the outlook, and is moreover also a relentless critic, when it realises there is weakness in its own generation, physical weakness, dare we also say, mental weakness, for which public opinion cries loudly for a remedy. Until we can diagnose a disease we do not generally look for the cause, but when we can see degeneration, and feel that we are in a measure responsible for a stunted and weakly race, there is no doubt that the cause must be looked for before an adequate remedy can be thought of. But before the cause is in this case actually defined, we can and must work for the future. Such subjects have been very often relegated to the energetic enthusiastic philanthropists of whom England is justly proud, but when the health and prosperity of our whole nation is affected, surely it is compulsory on those to whom the care of children now belongs to see that they, the men and women of the future, are not stunted and crippled for life.

Responsibilities of Authorities.—The general public is also slowly realising the fact that the duty of educating the children is now vested in the hands of municipal authorities and county councils, and as they realise it, it will become also clear that there are grave responsibilities attached, which have been only vaguely realised and unequally undertaken by rural and urban school boards and other school committees.

We are bound to look upon the education of children as the main

object of the education authority, but we cannot be blind to the fact that the physical development, the general health, the conditions in which the children work and play during their school hours are quite as important now and in the future as the manner in which their brain power is to be developed.

The question of how far this subject of the healthy condition of our schools and scholars can be efficiently grappled with, and by whom the burden of organization is to be borne, is one of immense interest.

Present condition of schools, &c.—In the past the responsibility of the condition and care of school buildings has been divided amongst school managers, inspectors, teachers and others, and in some cases this arrangement has been very successful, in some there have been too many who were partially responsible for the result to be good, and in some the matter has not been tackled at all, so that the result has been what might be reasonably expected, very unequal conditions all over England.

It will perhaps be useful to touch upon some of the weaknesses of the system, if it can be called a system.

Means of ventilation, however good in principle they be, are useless if out of order or ignored.

Lessons on cleanliness, personal and domestic, are useless if sanitary accommodation is insufficient and carelessly kept, or if the caretaker is negligent and slovenly, and is allowed to dry sweep and dust the schools without remonstrance, or if children are allowed to clean their slates according to their primary instincts.

The subject of the condition of the schools, their sufficient ventilation, the proper sanitary accommodation for teachers, girls, and boys, with due regard to modesty and cleanliness, the provision of playgrounds, well aired cloak rooms, and a good supply of drinking water, is a large one, and affords much ground for discussion and organization.

Supervision necessary.—It is certainly not enough to supply the necessities, there must be supervision in order to ensure their being properly used and kept in order.

Personal health.—We have spoken, however, of only one part of the responsibility of authorities, we must also consider the conditions which affect the personal physical health of the children.

Notification.—The major infectious diseases are of course notified direct to the medical officer and dealt with by himself and his officers, and if equal attention were paid to the minor infectious and other diseases many serious epidemics and much general illness might be avoided.

When absence from school is caused by illness, direct notification by

the teachers to the Health Department should be rigidly enforced, proper papers and envelopes should be provided, and the teachers instructed to fill these in with the necessary particulars every Friday before closing school. In the case of an epidemic daily notifications should be recommended; and it will be found that with the best teachers no compulsion will be needed—they quickly see that strict attention to such a rule tends to keep up the average attendance.

General Inspection.—Inspection of the children during school hours by a competent person is also to be recommended; children with bad sight, ophthalmia, discharging ears, ringworm, eczema, and other weaknesses so often found, and so often caused by dirt or neglect, will be detected, the children or parents directed to the proper sources for help, and the teacher advised as to whether the child is a danger to others, or only to itself. The discovery of children in the early stages of measles may often save much trouble.

Visiting children's homes.—Notification and inspection must be strongly recommended to all authorities, but unless they lead to systematic visiting of children and parents by a qualified and intelligent person little result may be expected.

Suggestions.—It is, as usual, much more easy to say what should be done, than it is to suggest what regulations should be made, and how they are to be enforced.

It has appeared to some who have had a little experience in matters educational and sanitary that the educational authorities will have sufficient work in the future without having to consider the developments in sanitation as part of their work, and that the subject comes more naturally under the consideration of the Health Department, both in urban and rural districts. In many cases, however, especially in large towns, this will mean a serious addition to the already heavy work of the medical officer—the head of the Health Department. If he is to add the responsibility of schools and scholars to his work, that is to say the efficient administration in this crusade against dirt and disease amongst our children, he must be provided with a competent staff.

Extra assistance.—In large towns or counties where the full time of the medical officer of health is already taken up, there will probably have to be an assistant medical officer, and in all cases duly qualified officials will be required to work under the medical officer.

Health visitors.—These officials may with advantage be well educated women, possessing the certificate of The Sanitary Institute, and if possible a little nursing training. Their status must be that of inspector, and their

title may be health visitor, or any other that may appear specially suitable in certain neighbourhoods.

These suggestions are put forward mainly with the idea of rousing discussion on the subject, and hearing what methods have been put into practice, and whether by exchange of ideas amongst experts some uniform scheme of organisation can possibly be suggested which will result in a generation of children, whose average prospects will be those of health and strength, instead of disease and debility.

Mr. G. W. Alexander (Glasgow School Board) said he had listened to these papers with a considerable degree of interest, and felt sure they were all at one with the authors in what they wanted. But he strongly deprecated the formation of another separate and independent department for this branch of school life and work. He was sure that the difficulty at the present time was not that they had insufficient knowledge or required more expert assistance; the difficulty was that they were not working up to the knowledge which they possessed, and by a long way were not making the best of the present situation. He was sure that when some of the suggestions made that morning were more fully carried out, and when they got the sympathy of the teachers, as they would do ultimately, they would get a great deal more of what they wanted in the direction of school hygiene from the teachers themselves than from any new department which could be imagined. He did not mean in reference to physical measurements and medical inspection, but what the teachers were able to do as a part of their ordinary teaching work.

Dr. R. H. Crowley (Bradford) pointed out that any separation of the duties in the way suggested would be rather a retrograde step, because they would be taking away an important part of the process of education from the Education Committee, which had to educate the children and send them into the world fully equipped. That committee should see after the health of the children and the healthiness of the buildings.

Miss A. Ravenhill (London) supported very strongly what Miss Evans and Dr. Crowley had said with regard to keeping the hygienic control of the schools in the hands of the Education Authorities. It is an exceedingly difficult thing to efficiently co-ordinate sanitary inspection, teaching, and practice, with the school curriculum, unless there were an intimate knowledge of the needs of the children, such as can only be gained by constantly living and working among them. Unless inspectors have that intimate knowledge they would not always realise all that requires attention,

nor would teachers be so likely to receive that consideration of their needs and difficulties to which reference had already been made once or twice that morning, and to which more heed should be given than had hitherto been the case. Again, if the authority became dual the question of inspection would become unduly complicated. In the provinces the inspectors of some of the local Educational Authorities had been encouraged to constitute themselves the advisers and friends of the teachers rather than their critics. The result was that the teachers were only too ready to bring to their notice matters bearing on health, which they might hesitate to do with men, whose chief work lay in other directions, and who only devoted a certain number of hours to each particular school at long intervals.

Mr. J. Cameron (Montrose School Board) said that, with regard to throwing more burdens on the teachers, he felt that teachers were often looked upon as beings apart, and not as co-workers for the benefit of the children and the good of the school. If those gentlemen set over the teachers as inspectors would only go to them with kindly words of advice and encouragement, the teachers would look to them for help in furthering the interests of the children and the development of the school. The one great want that members of School Boards and visitors felt was the need of more lady workers. They wanted lady inspectors to get in touch with the life of the children in the slums. As a School Board member he was persuaded that there would be a great deal of benefit accruing to both schools and children from the work of these ladies, who could understand more quickly and deal better with those with whom they came in contact than male officers. He agreed with the important place Miss Evans had assigned to the health visitor in the development of sanitation of the school.

A PLEA FOR CO-ORDINATION OF THE PUBLIC HEALTH OF SCHOOLS.

By THOMAS WOOD, J.P., M.D.Edin.

ABSTRACT.

THE question of hygiene, in relation to the spread of disease in schools, and the exclusion of children therefrom, also the subject of hygienic furnishings, such as school desks and seats, periodic disinfection of school buildings, with all books, slates, maps, &c., as well as careful medical supervision and inspection, has, considering the great and vital importance of the subject, received far too little consideration from the present constituted authorities.

On careful examination of the whole subject nothing strikes one more than the incongruous and anomalous condition in which school hygiene stands to-day, and the want of anything approaching the semblance of co-ordination between the different authorities controlling it. At the present time, for example, the Legislature has given the medical officer of health powers of control over the general sanitary arrangements; these can be inspected by him at any time, and all requirements necessary thereto he can order the local administrative authority to have carried out without delay. He has powers with regard to all notifiable infectious diseases, to prevent all infected persons being admitted to a school.

The closure of schools by the public health authority is provided for by Article 30 of the Education Code.

To the school board or local administrative authority are left whatever arrangements they may think fit or proper to make with regard to all non-notifiable infectious and other diseases.

In the enforcing and carrying out of all such regulations for preventing the rapid spread of these diseases, the teacher must take the initiative. This is not always an easy matter, because at the present time he is not entitled to call in medical aid to his assistance, except at his own expense. Even those notifiable diseases taken cognisance of by the public health

authorities frequently escape detection. Scarlet fever and diphtheria are often so mild in form that it is not thought necessary to see a doctor; a certain period elapses, and after what was thought to be a sore throat, a pupil may return to school, still a subject of infection, and may rapidly spread the disease.

The Education Department exercises control over all school buildings; it has a veto on the erection of all new schools. It also exercises its powers in this matter by giving or withholding grants of money. Provision for this is made under Chapter II., Article 17, of the Code.

A footnote says: "In administering this article, the department will endeavour to secure at least 80 cubic feet of internal space, and 8 square feet of area for each child, but in schools erected since the 1st of January, 1874, with the aid of the building grant or loan, the average attendance should not exceed the number of children for whom the plans were approved by the department.

This accommodation is inadequate. Each child should be provided with at least 200 cubic feet of air space, and 15 square feet of area.

It is on the report which is made by H. M. Inspector that the department acts. After schools have been built, therefore, the inspector becomes the authority in connection with heating, ventilation, overcrowding and all matters relating to the general hygiene of the schools and scholars. One naturally asks what capacity has the inspector for such work? His training has no doubt qualified him for dealing with all matters connected with the Inspection of Education, but he has had no training in hygiene, and cannot possibly b regarded as an expert in such matters, and he should, therefore, not be required to undertake this work.

Then, when we consider the department, we find that there is no expert in hygiene advising it. When the plans for a school are sent up to Dover House, they are remitted to the architect having control of that section of the work, whose decision on all such matters is absolute. The result is that the plans are returned stating: "My Lords approve; or disapprove; or request certain alterations to be made;" accordingly the work is proceeded with. This is a condition of affairs far from satisfactory, and in the interest of the public health of our schools should not be allowed to continue. Let us, for example, take the question of window space and lighting. There is perhaps no matter so deceptive as the adequate lighting of school-rooms. Light diminishes with extraordinary rapidity as one recedes from the window. The Scottish Education Department (Rules for the Planning and Fitting up of Schools, p. 5, r. ix.) says, "Every part and corner of a school should be fully lighted." It will,

however, be found in practice that this instruction is in many cases very inadequately complied with; sufficient care is not given to the following two points, viz., the height of the wall of the building opposite and the depth of the class-room from the window. The building requirements of the department do not enable them to judge of the nature and height of the buildings opposite (Rules, p. 3, r. i.), "A block plan of the site . . . . *20 feet to an inch.* This must indicate: (*a*) position of school buildings; (*b*) outbuildings; (*c*) playground; (*d*) drains; (*e*) entrances; (*f*) boundary walls; (*g*) roads; (*h*) the points of the compass: (*i*) the levels of the ground. N.B.—For the approval of the site alone the plan should show (*g*), (*h*) and (*i*)."

No indication is here given of the height of the walls of the building opposite, consequently there is no means of ascertaining whether the light of the class-room will be obscured by the windows being overshadowed by the walls of the building opposite, and the proper lighting of the class-room thus interfered with. Then with regard to the depth of the class-room. Although they have a rule which says (Rules for the Planning and Fitting up of Public Schools, p. 4. r. ii.), "The proper width for a class-room is from 18 to 22 feet," this has, unfortunately, in the interests of the children, not always been insisted on.

A school in this district, which I visited a short time ago, is a striking instance illustrating both the above points. On the opposite side of the street, the north side, there is a large malt warehouse which completely overshadows the school with its great dead wall, and shuts out the sky from the pupils sitting at the side of the rooms furthest from the windows on the ground floor, making the light here very bad. The south side is quite open looking on to a nursery garden. One of the class-rooms on the north side had a depth of nearly 30 feet from the window lighting it, with the result that this part of the room was altogether too dark, and two rows of pupils sitting here had no sky view. It was striking to note the point of vision taken up by these when compared with those sitting next the window. I measured the distance with a rule, and found that the average distance of each of the twelve pupils next the wall was $2\frac{1}{2}$ inches less than that of the twelve next the window, showing clearly that badly-lighted rooms are a cause of short vision and myopia.

With Wynn's meter for light I made the following experiment in the above school. In brilliant sunshine I found it took from two to three seconds to darken the sensitive paper to the required tint. The tests were made on a clear bright day.

SOUTHERN EXPOSURE (clear outlook):

	Min.	Sec.
Ground floor—Class room I.		
At 3 feet from the window, time exposure	0	20
At 18 „ „ „	3	15
First floor—Class room Ia.		
At 3 feet from the window, time exposure	0	22
At 18 „ „ „	2	5

NORTHERN EXPOSURE (facing Warehouse wall).

Ground floor—Class room II.		
At 3 feet from the window, time exposure	2	15
At 27 „ „ „	25	0
Ground floor—Class room III.		
At 3 feet from the window, time exposure	1	40
At 22 „ „ „	11	15
Ground floor—Class room IV.		
At 3 feet from the window, time exposure	1	35
At 22 „ „ „	10	40
First floor—Class room IIa.		
At 3 feet from the window, time exposure	0	30
At 27 „ „ „	3	45
First floor—Class room IIIa.		
At 3 feet from the window, time exposure	0	33
At 22 „ „ „	2	50

Class room II, already mentioned, in which I compared the sight of the children nearest the window with those farthest away, was undoubtedly too dark. The effect of the wall in obstructing light is shown when we compare room II with room IIa, the one which is immediately over it, and is therefore not so overshadowed as room II, which is on the ground floor.

It is impossible for one to work so well and continuously in a dull and badly-lighted room. It therefore becomes necessary that every child, when seated at work in school, should be in a position to see a piece of the sky. No child should ever be placed in such a position that a line dropped from the roof or top of the opposite building, and passed downwards at an angle through the highest transparent point in the school window, will, when continued, fall below the level of the eyes of the pupil when seated at the desk. It is essential that light should fall directly from the sky upon the pupil's place.

At the present time there is no universal system for the exclusion of non-notifiable infectious diseases. School Boards simply do as they think best, and the steps taken may, or may not, be sufficiently far-reaching. What is needed, and what seems to me the only remedy for such an unsatisfactory arrangement, is the constitution of some authorised expert body, to lay down regulations which would be universally applicable for all the above matters. This should not, as at present, be left in the hands of non-expert bodies such as School Boards, who cannot be expected to have the requisite knowledge on these points.

All matters connected with the public health of schools should be removed from the control of the Education Department and School Boards, and co-ordinated under one authority. One naturally desires that this body should be a State department of hygiene, exercising its functions through the medical officer of health for the district in conjunction with the present medical advisers of the Local Government Board. They, of course, would naturally be transferred to this department, and should examine the schools periodically. In addition to these, local medical men, working conjointly with the medical officer, would require to be appointed to the different schools, so that the headmaster of the school might be able to call upon them to decide in difficult cases whether or not a child, or children, should be excluded from school. They could also undertake the periodic inspection of all scholars, as well as the examination of all pupils on their first admission to school. That such inspection and examination is necessary is now pretty generally admitted. Failing the establishment of a State department of hygiene, what should be done is to place the management and control in the hands of the Medical Department of the Local Government Board.

[*For Discussion on this Paper, see page 990.*]

APPLIED PHYSIOLOGY IN THE SCHOOL-ROOM,

With Special Reference to the Subject of Posture.

By Miss A. RAVENHILL.
(Fellow.)

THE increasing realisation that the bulk of achievements during the era of independent individual life depend mainly for their symmetry, utility, and worth upon the moulding influences active in early youth has already borne fruit in the now general recognition that direct training in the theory and practice of teaching is indispensable even for the most cultured students who propose to adopt the calling. Hitherto, however, the equal claims of physical culture and hygienic surroundings have been largely subordinated to those of intellectual and moral training. For this reason, a debt of gratitude is due to Herbert Spencer for his forcible enunciation of the fact that education is an important branch of sociology: consequently its methods should be deduced from a study of biology and psychology. A careful observation of the life history of the simplest organisms in the vegetable and animal world; patient, scientific study of the phases of mental development in primitive races and in children; these will afford invaluable guidance to, and should constitute an invariable part of, the training of those who assume the rôle of educators.

Some systematic, practical study of Physiology and Hygiene, therefore, seems imperative for the educator, whatever be his official capacity. In the case of teachers the desirable ground could be covered in a year, if about five hours a week were devoted to instruction, laboratory work, practical observations and private study; in less time if a previous knowledge exist of the elements of biology, chemistry, physics, and psychology.

The course should, in my opinion, be framed somewhat on the following lines, which experience has shown me to constitute a serviceable equipment. Life, its manifestations and essential requirements, and how these things are influenced by heredity, nutrition and environment, should constitute the introduction (the simpler vegetable and animal forms

being chosen for the purpose of practical observation); to be succeeded by a rapid survey of the properties, character and control of the chief media of life—air and water. Then it is advisable to concentrate for a time on human physiology, with just so much anatomy as is requisite to an intelligent comprehension of the mechanics of the body. After a brief survey of the general structure of the body, the nervous system should be carefully considered in its general aspects, preceding a study of the other great systems (the circulatory, respiratory, assimilative, excretory, osseous, muscular, &c.); and after the interdependence and normal functions of these have been considered, the brain and special senses could be dealt with in detail. Hitherto, few have attempted a sufficiently detailed study of the whole nervous system. This should deal primarily with its elementary divisions, structure and mode of action, so far as at present understood; and should then proceed to a consideration of its dependence upon judicious stimuli for due performance of its functions, yet the necessity for the power to function to precede and co-exist with such stimuli; and of its instability, especially at the periods of dentition and adolescence. Attention ought to be turned to the evils which follow premature forcing of function; to the fact that the power to control or inhibit actions succeeds, sometimes at considerable interval of time, the power to perform; to the physiological value of multiplying paths of association between the various brain centres of sight, speech, hearing, &c.

The subsequent study of problems of diet and personal and domestic hygiene would then be of great interest in their bearing upon the perfect development of both body and mind. Sectional hygiene follows fitly at this point in the course: the gradual and unequal growth and needful care of infant and child preceding consideration of the special hygiene of school life. Finally, acquaintance must be made with the chief promoting causes of disease, communicable and otherwise, and a brief résumé given of the machinery for promoting and protecting public health in Great Britain. This portion of the course proves, when ably handled, not the least serviceable: it serves to indicate convenient and attractive methods for the inculcation of civic responsibilities and duties; and suggests opportunities for the culture of a wisely altruistic spirit in our schools.

It is possible that a detailed example of the ample scope afforded by just one department in the schoolroom for the employment of information gained in such a course, will carry more weight than the multiplication of mere cursory references. I have selected the hygienic importance of posture for this purpose, because it offers an excellent illustration of the call for more than a merely theoretical acquaintance with physiology and

mechanics, while indicating the field afforded to the school hygienist for immediate application of his knowledge.

The practical importance of the duty of maintaining bodily symmetry should constitute sufficient reasons for devoting more intelligent study to what Dr. Mosher, of the Michigan State University, describes as the "mechanics" of the various postures which the body naturally takes standing, sitting, and lying, so that a decision may be reached as to which postures may be permitted to become habitual, which tend to impair health or to mar symmetry, and which can be controlled by school furniture and a well-arranged programme of lessons. Dr. Mosher's presentation of this point seems to me of such worth and suggestiveness that I proceed to give a concise synopsis of her views.*

> "The human skeleton," she writes, "viewed from the standpoint of its mechanics, consists of a pedestal, the pelvis, upon which rests a flexible, upright column, the spine. To this flexible upright are fastened twenty-four ribs, these, with the costal cartilages and sternum, form the chest, which is suspended from the spine anteriorly in the middle third. Along the sides of the chest the arms hang, being attached to the scapulæ, through which they, as well as the chest, derive support from the spinal column; upon the summit of the latter the head poises, its range of movement being such as to permit its weight to drag upon the upper part of the spine in all directions. The trunk thus formed rests upon two unstable jointed supports, the legs, which, when not in use as supports, often act as weights suspended from the pelvis. A line passing through the centre of the head and trunk to the middle of the space between the feet, divides the body into lateral halves, which are symmetrical and balance each other in weight. From the front to the back this line does not divide the body symmetrically, owing to a dissimilarity in the bones of the skeleton anteriorly and posteriorly. The distribution of weight differs here also, the forward projecting chest with its contents finds its counterpoise in the backward projecting sacrum with its load of gluteal muscles. Muscles and gravity are the forces which move the skeleton and hold it stationary; muscles elevate it to the upright position and arrange its parts, so that gravity, acting upon equal masses, can hold it in place with little expenditure of muscular force. It is evident that the apparatus must be a complex one, which can move at will such a jointed and weighted structure as the human skeleton; the distribution of material must also be accurate to make equilibrium possible upon a base as narrow as that presented by the feet . . . . A healthful poise of the body is one which permits the various organs which it contains to hang evenly upon their supports, without encroaching upon one another, in which also the distance between the origin and insertion of muscles is such as to permit them to do this work with the least expenditure of contractile force. Upon the position of the pelvis depends the shape of the superimposed trunk, since to equilibriate, the spine—with its weight of chest, arms, and head—must keep the centre

* "Flat chest; produced by Habits of Posture." Eliza M. Mosher, M.D. *The Brooklyn Medical Journal*, June, 1896.

of mass over the centre of support. This is well exemplified in an individual having one leg an inch shorter than the other; the loss is too slight to be remedied by the rising on the toes, so the pelvis drops on the shorter side to reach its support. The spinal column, to maintain the body in equilibrium, bends towards the elevated side, carrying with it chest, arms, and head. All the organs within the trunk are thus made to hang at an angle of inclination, and the muscles of the corresponding sides work at unequal distances. The laternal spinal curve, produced in this way, is the unavoidable result of inequality in the supports of the pelvis, and is liable in time to become exaggerated. The chest is fundamentally modified in size and shape, by the habitual poise of the pelvis in sitting and standing. The sternum recedes from the spine or approaches it according as the 'angle of obliquity' at which the pelvis is held, is increased or diminished. The 'angle of obliquity' depends upon the action of the lumbo-sacral muscular apparatus, aided by the extensor muscles of the legs and feet. After elevating the trunk into an upright position, the lumbo-sacral muscles should transfer their leverage to a higher point and elevate the pelvis posteriorly. By this means the gluteal weight is carried outward and upward, to balance which the chest must be held with its rib walls in their best position for the free movement of the inspiratory muscles and diaphragm." . . . . In this position the muscles which make up the abdominal cylinder maintain their normal length, the shoulder blades occupy "a vertical plane in *front* of that presented by the most projecting part of the pelvis. The balance of the trunk is so perfect that the head is not needed as a counterweight . . . . and the weight of the body falls upon the feet at a point just in front of the ankle joints."

FIG. 1.

FIG. 2.

The accompanying illustrations, reproduced from a series of photographs taken to exemplify the points to which I desire to draw attention, bring out the significance of Dr. Mosher's remarks upon the relation between posture and symmetry.

The pose of Fig. 1 is familiar to us all; the diminished chest capacity, unsymmetrical equilibrium and relaxed muscles indicate lowered vitality and debility, while they predispose to tuberculosis, nervous trouble, and dyspepsia.

Fig. 2 illustrates the position to be encouraged in the interests of health and symmetry.

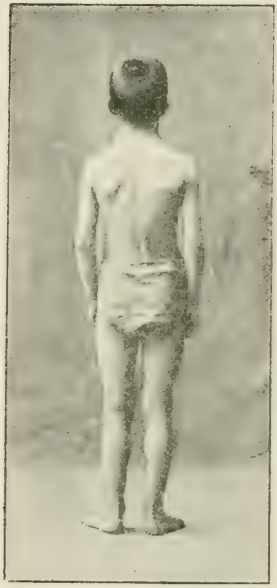


Fig. 3.

Fig. 4.

Fig. 5.

The next three of the series illustrate three ways in which the legs support the trunk; all other postures in which equilibrium is maintained being modifications of these.

Fig. 3, with both extremities placed evenly beneath the trunk.

Fig. 4, with one leg supporting the trunk, the other thrown forward as if in walking.

Fig. 5, with one leg supporting the trunk, and the weight thrown to the side.

In Fig. 3 the trunk is evenly poised upon its supports, with all its

parts symmetrically placed. This would be a proper pose to assume habitually were it not that it keeps both extremities in muscular activity at the same time, whereas they demand the privilege of working alternately. Involuntarily one support drops out from under the weight, and the position changes to Fig. 5, objectionable, because fruitful in the production of lateral curvature of the spine, thus affecting the development and symmetry of organs and muscles throughout the body; but nevertheless commonly chosen because of the broader base given for the support of the trunk.

Fig. 4 illustrates the posture which children can be taught habitually to adopt, the rule for their guidance being simple enough. Raise the chest, place shoulders and elbows upon the line of the hips, draw the chin well back when the head is level, throw the weight upon the forepart of the feet. It will be observed that the bones of the skeleton are all so placed in this posture as to retain the muscles in normal symmetrical relations as regards the distance between their origin and attachment, the direction of their fibres, &c. The backward movement of the head and shoulders to balance the weight of the forward leg calls into action the muscles of the back and shoulders, while those upon the front of the body are placed in an equal degree of extension. In addition, not only does the chest project forward and upward when the head is erect, providing ample space for residual air as well as favouring tidal respiration, but the head cannot drop to either side without disturbing the equilibrium of the body, which implies that the soft tissues of the face retain their symmetry.

> "The ease with which the weight of the trunk can be transferred from one extremity to the other," writes Dr. Mosher, "makes this a position which can be retained a long time without fatigue. . . . . Because of the narrow base which it gives to the body, however, and the corresponding sense of insecurity which the individual unaccustomed to it feels, this is not a posture naturally chosen, but it is one easy to assume, and children should be taught to fall into it habitually. If standing for a long time it is advisable to place one foot with the heel behind the waist line and the other a little in advance; make the knee of the posterior leg firm, and rest the weight of the body upon it, relaxing the muscles of the other leg. Transfer the weight from one leg to the other without changing the position of the pelvis; only remember that the muscles of the legs *must* be trained to hold the knees firm (one or both) when the weight of the body is resting upon the feet; the lumbo-sacral muscles must habituate themselves to hold the gluteal weight high in standing, sitting, and walking." *

* "Habitual Postures of School Children." E. M. Mosher, M.D. *The Educational Review*, Nov., 1892.

It may be suggested that faults in standing claim less of the attention of school authorities than do those which occur in sitting, in the amelioration of which an increasing interest is now being aroused. The enormous importance of hygienic school furniture becomes readily apparent when studied by the light of physiology, anatomy, and mechanics, and I owe much to suggestions received on this point from Dr. E. M. Mosher.

It must be borne in mind that the body naturally assumes a variety of attitudes in sitting, as in standing; of which some are directly injurious to health and symmetry. Fig. 6 shows an ideal pose, with pelvis resting

Fig. 6.

Fig. 7.

equally upon the chair, or other support, spinal column erect, the head poised upon its summit, the arms balanced upon a line with the hips, and the trunk in a symmetrical position. It is a position in which gravitation largely replaces muscular activity, and therefore it is economic in force. With support applied to the lower part of the back and below the shoulder blades, it can be maintained a long time without general fatigue. It is, therefore, the position which should be acquired in early life as the habitual one in sitting, and should be fostered by the general adoption of seats and desks adapted to its maintenance.

Unfortunately, we are more familiar with the flattened, contracted chest, the stooping head, and rounded shoulders depicted in Figs. 7, 8, and 9. The results of these positions involve serious interference with thoracic development: the abdominal organs cannot function freely; and, in addition to unsymmetrical and unequal muscular action, a train of other undesirable symptoms is liable to follow, especially in the case of growing girls, who are more liable to adopt and retain this unwholesome posture than are their more actively-disposed brothers.

Fig. 8.

Fig. 9.

Fig. 8 illustrates how, "with the pelvis slipped forward upon the chair and shoulders braced the weight of the trunk falls mainly upon the sacrum and coccyx. These bones are not sufficiently cushioned by flesh to protect the curves which lie upon their surface, hence the latter are liable to become injured by the pressure thus applied. In this position, too, the normal curves of the spinal column are replaced by one long one, with its convexity presenting posteriorly. Important muscles and ligaments are thus placed unduly upon the stretch, making permanent curvature of the spine in this direction easy of occurrence in individuals of weak and lax tissues."

Fig. 9 shows the serious error committed when children are allowed habitually to stoop forward or to fold the arms across the chest. "In this position the chest muscles, after drawing the arms forward, remain in the

position of contraction, one which is unfavourable to free inspiration. The shoulder-blades are widely separated, with their posterior borders averted. The weight of the head drops upon the muscles which connect it with the spine; these, with the other back muscles, become elongated and weakened by this gradual stretching process. The upper antero-posterior curve in the spinal column, under the influence of this posture, deepens, and the obliquity of the ribs increases, diminishing the capacity of the chest and with it the vital force of the body. Furthermore, this posture tends to fold the body together upon its anterior aspect. The result of this is to crowd the contents of the abdomen backward and downward, with the secondary effect of displacing and deforming the moveable and easily moulded organs of the pelvis. . . . ."

Fig. 10.

The last position illustrated (Fig. 10) shows the shoulders placed diagonally to the transverse diameter of the hips, with the spinal column in rotation. Upon the evils of this it would seem unnecessary to enlarge, were it not that it is exceedingly injurious if permitted to become habitual, because it places the bony segments of the spinal column in a position calculated to produce elongation of some of their connecting ligaments with shortening of others; at the same time the cartilaginous discs between the vertebrae suffer seriously from the unequal pressure, which diminishes their thickness on the shortened side. The muscles of the back are also used unequally.

Right here, as the Americans say, the well-equipped school hygiene steps in with some practical proposals for remedial and preventive measures:—

(1) Encourage and develop a good physique by assembling the children in airy, well-lit buildings only, so that the hours of unnatural confinement may be spent under the best possible conditions, supervision being also exercised over the school lunches and the wise employment of the hours of recreation: for it is in the poorly-nourished, debilitated and overworked that the muscles and soft tissues are most readily moulded by posture.

(2) Pay far greater attention in the future to variety in the school routine; constant change of posture, promoted by a more varied programme of occupation, being even more essential for the delicate than for the robust, for girls than for boys.

(3) Educate public opinion to recognise the true economy of superseding defective, ill-constructed desks and seats by those designed on soundly scientific lines to promote a healthy posture and good habits in sitting, writing, reading, &c. Switzerland, Germany, Italy, and the United States have all found undoubted advantages to follow on the tentative efforts they have made towards the improvement of school furniture, and Great Britain has the assistance of their experience as a guide to her steps. It seems to me that, recognising the immature condition of children's bones and muscles, it is important to construct a seat economic of force (*i.e.*, in which gravitation largely replaces muscular activity) and conducive to as easy and symmetrical a position as possible (that is, with pelvic bones resting equally upon the seat, the spinal column erect, the arms balanced on the line of the hips, the thighs level, the feet resting wholly on the floor). To secure this—

(1) the seat must be adjustable as to height ($\frac{1}{4}$-inch adjustments over the whole range of its elevation or depression);

(2) the bottom of the seat should be somewhat concave (not exceeding $\frac{3}{8}$ inch), this concavity to begin $1\frac{1}{2}$ inches from the front edge of the seat, the deepest part where the seat bones rest; the seat itself should also be slightly inclined from the front backwards, not to exceed half an inch, the front rounded, otherwise the circulation in the legs may be impeded, or injurious pressure exerted on the sciatic nerves, both evils fruitful in subsequent suffering. The actual depth and width of the seat would naturally vary according to its size; the depth should be $\frac{2}{3}$ the length of the thighs of the child who is to occupy it; the width slightly greater than the two

thighs. A greater width is in the opinion of many experts a marked incentive to bad postures;

(3) The back rest must: (*a*) permit the pelvis to project *behind* the shoulder line, otherwise the body is unbalanced (most existing seats are so constructed that the shoulders project behind the hip line); (*b*) be slightly concave towards the front, and, in the case of young children, should only extend to just below the shoulder blades, in order to permit of free arm movements. For those who are older I think the back rest should be high enough to support the lower parts of the shoulder blades; it should also very slightly incline towards the front; (*c*) a freely movable hip-rest to support the small of the back is advisable, especially in seats planned for girls' use. Where, however, bench seats are demanded and this second support must be fixed, it is wiser to forego it, and depend solely upon a single broad bar just below the shoulder blades, as its whole virtue hinges on accurate adjustment to each child's figure. Every portion of the seat should combine strength with simplicity, for purposes of adjustment or of dusting: the substance should be impervious, and all requirements must be combined with a reasonable cost.

The desk must be easily adjustable to correspond to the height of the seat, it must be adaptable with equal facility to the plus, minus, and zero positions; the angle of inclination should preferably permit of adjustment for reading, writing, or manual occupations: stability must be assured, yet simplicity of construction must favour facility of movement for cleaning or other purposes.

School desks and seats adjustable to different heights and positions have been in use for a long time in the United States, and that known as the Shaw-Chandler chair and desk possesses many admirable points. In the United States it is usual for each teacher to make the necessary measurements on his own class, at intervals of six months, by means of a measuring gauge such as Chandler's. A list of the necessary adjustments is then handed to the janitor, who is responsible for their accurate execution out of school hours. Given intelligence and interest the system works smoothly: four castings or sizes of such adjustable seats and desks prove sufficient. Dr. Silvio Belotti, Medical Inspector of Schools at Milan, has found the procedure facilitated and checked by the use of the following forms:—

Dimensions of seats in respect of the sex and of the height of the scholars.

School.	Age.	Height of the child.	Height of the Seat.		Distance between seats and desk.		Height of the back.	Width of the desk.	Depth of the seat.
			M.	F.	M.	F.			
Elementary School.	From 6 to 14 years	M. 1·00	0·30	0·30	0·16	0·16	0·20	0·35	0·20
		M. 1·10	0·32	0·30	0·18	0·20	0·30	0·35	0·24
		M. 1·25	0·36	0·34	0·20	0·22	0·30	0·40	0·27

* "The sanitary official," he writes in his book on School Hygiene, "takes note of the heights of the pupils in the course of his practical inspection at the commencement of the school year, in order to assign to them suitable seats, and fills up Form A accordingly, which is transmitted to the Health Office"; presumably for future reference.

Measurement of the height of the scholars for the assignment of seats.

Commune of..... Form A.

Elementary School. M..... or F..... in.....Street.

Classes.	Number of pupils measured.	Seat I.	Seat II.	Seat III.	Seat IV.
		Pupils who do not exceed M. 1·10.	From M. 1·10 to 1·22	From M. 1·22 to 1·34	From M. 1·34 to 1·50
Class I.....					
,, II.....					
,, III.....					
,, IV.....					
,, V.....					
TOTAL					

Facilities for the adjustment of desks to various uses have been largely adopted in Switzerland, but the benches or chairs employed are quite unsatisfactory.

A realisation of the true economic value to the nation which would result from this cultivation of sounder, more symmetrical bodies, and of coincidently saner, more wisely restrained minds, is necessary to give the desirable impetus to the improvement of school furniture.

[*For Discussion on this Paper, see page 990.*]

* "L'Igiene della Scuola," Dott. Silvio Belotti. Milano, 1904.

THE GREAT IMPORTANCE OF HYGIENIC SCHOOL DESKS & SEATS.

By THOMAS WOOD, J.P., M.D.Edin.

ABSTRACT.

SCHOOL desks and seats have not received the attention which they deserve, especially with regard to sound principles of construction. The desk should be so constructed as to enable the child to sit in the best hygienic position possible, one having the least injurious effects physically with regard to posture and eyesight. The child should be taught to sit in a position both easy and graceful, and school desks should always admit of this. The great majority of desks in use in schools at the present time are dual, and are so constructed that they force the children to adopt positions which tend to curve the spine to the left, and cause the child to stoop forward, with the result that the chest is contracted, the heart and lungs compressed, the abdominal viscera cramped, this latter condition also favouring curvature of the spine backwards. When the child has finished its school life, the position and shape of the bones in many cases have been altered, resulting often in permanent disfigurement. In regard to this matter many of the teachers give little or no attention. With a knowledge of the principles of the proper seating of a child, a great deal could be done to improve matters by a judicious selection of desks. Children vary greatly in size in different classes. They also vary in size at different ages. Professor Bowditch, after examining about 25,000 boys and girls of Boston, has shown (The Growth of Children, studied by Galton's Method of Percentile Grades, Twenty-Second Annual Report of the State Board of Health of Massachusetts, 1890, p. 479—522) the amount of variation and height at different ages. The following figures are taken from his report, the ages of the children given is that at their last birthday :—

			Inches.		Inches.			Inches.
Six years ...	Boys	.....	40·66	to	47·13	.....	difference	5·6
	Girls	.....	40·57	„	47·36	.....	„	6·79
Eleven years	Boys	.....	49·47	„	57·50	.....	„	8·03
	Girls	.....	49·33	„	59·96	.....	„	8·63

		Inches.		Inches.
Fifteen years	Boys	56·55 „ 67·90	..... difference	11·35
	Girls	57·39 „ 65·00	..... „	7·61

This shows an absolute necessity for provision being made whereby the desks and seats may be adjusted to suit the variations in height of the different children.

It will be interesting to note what the Code of the Board of Education (Scotland) says on this matter: "Benches and desks graduated according to the ages of children should be provided for all scholars." In the light of the above figures this must be regarded as wrong in principle, and should, therefore, be changed, and brought more into conformity with facts. Hitherto, it has been the custom for a boy a foot taller than another boy to sit at a desk the same height. Then the average sitting height for boys and girls is not the same, that for boys being proportionately less than that for girls. These facts being taken into consideration, it becomes evident that to get a suitable desk and seat recourse must be had to some mechanical contrivance which will permit of its being raised or lowered to suit each pupil. Eulenberg (Schulgesundhutslehre, Vol. I., p. 271, 1900) mentions that Barnard was the first in the United States to establish the use of movable desks and seats. This, however, unless certain other factors are taken into consideration, is not enough. The desk must be constructed so as not to cause the pupil to adopt a wrong position, nor must it favour short-sightedness.

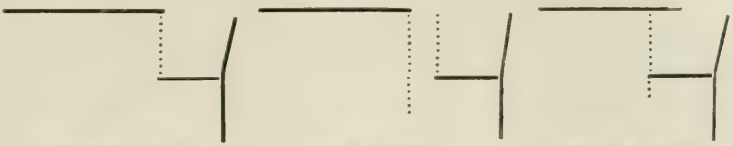
In order to lay down certain definite hygienic principles for the proper construction of desks, it is necessary to bear in mind certain simple physiological and anatomical facts. When a child sits, the two ischial tuberosities should rest equally upon the seat, the body should be in an erect position, the arms hanging down by the sides and thighs, the head should be poised in such a position that a line dropped through its centre of gravity and that of the trunk falls vertically through a point in the centre of a line drawn transversely between the two centre points of support of the two ischial tuberosities. The thighs should be in a horizontal position, the legs vertical, the feet resting on the floor. In this attitude the body is in a symmetrical and equally-balanced position, therefore the most economic so far as muscular energy is concerned, as well as the most conducive to correct carriage and physical beauty. The attitude of ease and grace should always in school life be cultivated.

The requirements of school work are such that the above position cannot always be maintained. Writing, reading, drawing, and slate exercises require a desk for their performance. Improperly-constructed

desks lead to deformity of position and short-sightedness. In laying down certain principles for the proper construction of desks, one has to bear in mind that the posture deviating least from that already indicated, and coinciding with the following, will be found to be the correct one. Sitting in the aforementioned attitude, with the head properly poised, it will be found that the eyes are directed forwards and downwards at an angle of 45° to the horizon. If kept looking in a horizontal direction a somewhat greater strain will be required to raise and keep them in that position, *e.g.*, it will be found that one can only look with an effort at a near object if it be higher than the eye. On the contrary, one can look with ease at an object equally distant, if it be below the eyes. So far, then, as sight (reading) is concerned, the proper position would be at a point 12 inches distant where the axes of vision converge, the desk here cutting the line of vision at right angles (which will also be at an angle of 45°). This, theoretically, is the correct position for an individual with normal vision, and for the purposes of reading can easily be given effect to. In writing, however, it will be found that, with conditions such as these, the ink would not flow properly from the pen, and it would be irksome to place and keep the arms in such a position. The desk must, therefore, be arranged at an angle of 12°, but not more than 15° to the horizon, consequently, it will not cut the axis of vision at right angles, which is no doubt the best plane for effective vision. This undoubtedly brings the lower part of the desk nearer to the eye than the upper, and will give rise to what is known as foreshortening; this, however, cannot be avoided. It must also be so devised that the arms can be easily and comfortably placed upon it; the elbows when so placed must not be further away from the sides than from 3 to 4 inches, otherwise the arms, with the shoulders, would be raised too high, and an improper position consequently assumed. The two following most important definitions are given by Janke (Grundriss der Schulhygiene, 1901, p. 111) with regard to the measurements of school seats and desks. The *difference* is the vertical distance from the inner edge of the desk to the seat, or to the extended edge of the seat. This distance must be such that the edge of the desk must be opposite the navel, so that the pupil, when sitting erect, may place the arms upon the desk to write, with the elbow bent a little on one side and in front of the pupil. The *distance* is the horizontal interval between the front edge of the seat and the vertical line let fall from the edge of the desk. If this line coincide with the edge of the seat, the distance is called a zero distance; if the line falls in front of the seat, it is a plus distance; if behind it, a minus distance. This, therefore, gives three kinds of desks.

Taking into consideration the principles already laid down, with

regard to the proper attitude for reading, it will be evident that in writing, the desk which will entail the least alteration from that position will be the right one, and a minus desk will be found to fulfil these conditions most closely. If the desk used be a plus desk, the head and



ZERO DESK. PLUS DESK. MINUS DESK.

body will then require to be thrown forward, the spine will be curved, the thorax, lungs, heart, and abdominal viscera more or less cramped; full and free expansion of the lungs will be restricted; the lower part of the abdominal wall becomes folded up and the viscera displaced, and their functions consequently interfered with; there will also be greater expense of muscular energy in holding the head and body up in this position because they are not well adjusted or properly balanced, as a result greater fatigue will be produced; also when the head bends forward with the body, the distance between the eyes and the desk will be such as to conduce to short-sightedness. Too low a desk will produce practically the same result with regard to position. Therefore the minus desk arranged so that the edge of the desk just touches the abdomen without pressing on it will enable the child to sit in the most symmetrical attitude, whilst engaged in writing exercises, and the weight of the body will be found to fall through the centre of a line joining the ischial tuberosities. If a plus desk be used, the weight of the body falls in front of this and the part of the thigh resting on the anterior edge of the seat comes to take part in supporting the weight, as well as the elbows on the desk. A fixed minus distance such as this at all times, however, would oblige the pupil to remain in a posture which would ultimately become tiring, and freedom of movement would be limited, both rising up and sitting down would be awkward. The desk should therefore be hinged somewhere near the middle so that it can be lifted up and folded back upon itself so that the under-surface may come to lie at an angle of 45° to the horizon and thus cut the plane of the axis of vision at right angles, and should be at a distance of slightly over 12 inches from the eyes of the pupil when properly seated. The desk would then become a plus desk, and with a book opened and placed upon it, the proper conditions for reading would thus be obtained. Such a desk would admit of the most perfect attitude, both in reading and writing, as it is possible to arrive at.

[*For Discussion on this Paper, see page 990.*]

SOME PARTICULARS OF ADJUSTABLE SCHOOL FURNITURE.

First seen in Continental Schools.

By JAMES GRAHAM,

Inspector of Schools to the West Riding County Council.

THE present time, when Education Acts are placing additional responsibilities on the shoulders of county councils and municipalities, is an opportune time for all who are interested in the well-being of growing children and adult students to direct attention to the urgent necessity for a hygienic revolution in the school furniture of our country. Very little attention indeed has, as yet, been given to this question by our countrymen.

That there is great variation in the height of scholars is well known. Observation shows that the difference in heights of children of the same age may vary from six to eleven inches, and these various differences in height and growth can only be accommodated by desks and seats the height of which may be easily changed.

In almost all our schools, however, from the highest to the humblest, the bodies of the scholars have to accommodate themselves to fixed seats and benches, and many evils arise from this system, even where the desks are in a rough and ready fashion adapted to the size of the scholars. A large percentage—much larger than is generally supposed—of our school children have a tendency towards eye and spinal troubles and consumption, and investigations have shown that being seated hour after hour accommodating themselves for all kinds of work to a fixed desk adversely affects boys and girls—and particularly girls. This is most harmful in the case of young children, but the inconvenience is also very pronounced in the case of the young adults, and of fully grown men and women in attendance at technical and evening classes held in elementary school buildings, or even in secondary school premises, where only the ordinary school equipment designed for children is available.

"Hygienic" desks and seats reverse the old order of things, inasmuch

as they accommodate themselves to the bodies, backs, legs, and eyes of the users. They provide, in addition, the natural slope required for reading, writing, and drawing, and the height of desk suited to the length of the scholar's body. In short, "hygienic" desks and seats should be so

KINDERGARTEN — STANDING.

KINDERGARTEN — READING.

designed as to lead each person almost unconsciously to assume a natural and hygienic position; and supports should be provided in the case of very young children, where necessary, in order that the correct position may be maintained with a minimum of strain.

KINDERGARTEN—DRAWING.

In the few adjustable desks at present available the movement is a vertical one only, and the height is laboriously altered and fixed by means of a key, a screw, or a pinion, the slope of the desk remaining fixed, or

nearly so. The principal defects of the key, screw, or pinion desk, from a practical point of view, are that such desks are not readily adjustable, also that accidents happen to the fingers and hands of the persons using them. Other defects exist in regard to fixed slope, &c., which those who have made a careful study of the question from the hygienic point of view may deal with more fully than I can possibly do to-day.

The collection of *pupitres hygieniques* to which I wish to direct your attention have neither the key, the screw, the crank, nor the pinion movement, and have been designed in accordance with hygienic principles. I met with them while visiting Continental schools some two years ago, when they struck me as being a great advance on anything I had previously seen.

I inquired into their history and discovered that they had been

ELEMENTARY No. 1.

ELEMENTARY No. 2.

invented by M. Mauchain, of Geneva, and that a Special Commission of School Hygiene appointed by the Swiss Government—who give a great deal of attention to the subject of school hygiene—had, after rejecting all key, screw, and pinion movements, selected these desks, and adopted them as the official patterns. At the Paris Exhibition of 1900, in the Hygienic School Furniture Section, they gained the only gold medal, in competition with Continental and American "hygienic" desks.

Specimens of the desks were imported by the West Riding County Council shortly after my return to England, and since then, under the direction and guidance of Miss Alice Ravenhill, the firm of Illingworth, Ingham & Co., Ltd., of Leeds, have been making experiments with a view to improving the *desks* and to producing *seats* which may be as satisfactory as is the movement of the desks—that is to say, we are in search of a

series of desks and seats for elementary, secondary, and technical school purposes which are readily adjustable for the use of children and adults. I give you a series of illustrations in order that you may have an opportunity of seeing the present results of the experiments and of examining them closely.

As regards experiment and improvement, the *desks* only have thus far received attention, and they are considered to be now fast approaching the satisfactory stage; the *seats*, however, are not regarded as nearly satisfactory as yet. The first series of experiments are in progress, under the direction of Miss Ravenhill, and it is hoped, quite soon now, to greatly improve the seats. An adjustable seat, single pedestal, with a rise of

SECONDARY No. 1.

SECONDARY No. 2.

4 ins. in the seat, and of 2 ins. in the back rail, is just on the point of being produced.

The movement of the desks is, I think, satisfactory. It is so simple that it can be easily manipulated by a child, and this without danger. Further, I have seen desks that had been in use for ten years, showing but slight signs of wear. The movement, therefore, is strong, and the desks maintain their rigidity.

Examining the desks in detail, one can notice a number of interesting points.

Turning to the *Kindergarten* desk, you notice that the child can work at it sitting and standing, that it gives the natural slope for the eye for reading, and that whilst reading the head may be easily held up and the back kept straight, also that the top, turning upon its hinges, the underside answers the purpose of a blackboard on which the little ones may

practice in large-hand their first steps in writing and drawing, a left arm support being provided so that the correct position may be maintained without strain. Instead, however, of the underside being black, it is coloured a deep brown (*brun foncé*), which is better for the eyes.

The *Elementary School* dual desk is so adjustable that the children can work at it sitting, with the desk quite flat, or standing, with the desk also quite flat at its greatest vertical height when necessary, and it can be fixed quite flat at any intermediate height; in addition, the slope of the top of the desk can readily be given any angle within the extreme limits of height.

The *Secondary School* single desk has the same simple means for obtaining a variety of adjustment, and I may perhaps here state that in my opinion *all schools should really be furnished with adjustable single*

Secondary. No. 3.

desks and seats to ensure that each scholar may get the adjustment that exactly fits his or her body. No matter how carefully one selects the pairs of children for dual desks, it is almost impossible to find *fac-simile* pairs. At the best one can only average matters as regards adjustment with dual desks, but even this is infinitely better than fixed desks can possibly be made to be. *It is to the single desk that I wish to direct particular attention.*

For *Technical School* purposes the following desk is being used in rather small technical schools in the West Riding of Yorkshire. The pattern was decided upon in view of a desire to utilise the same accommodation partly for ordinary drawing, partly for building and engineering students, partly for commercial students, and also for women's classes in

cutting-out, dressmaking, etc. The desks have been in use for two sessions, and have given great satisfaction. This desk is largely in use in the Swiss professional schools for girls, for domestic arts classes, including cookery, starching and ironing, etc.

For *Building*, *Engineering*, and *Architectural* drawing, a somewhat larger pattern, which has an attachment at the side for carrying colours,

Technical, No. 1.

Technical, No. 2.

instruments, etc., is sometimes adopted. This type of desk is in use at the Polytechnic, Zurich.

Some excellent features which may be claimed for these "hygienic"

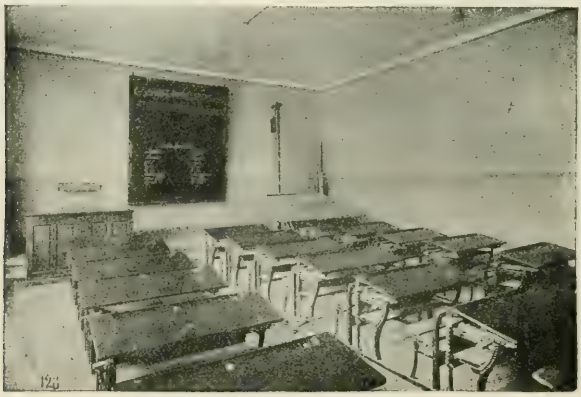
Engineering, Architecture, etc.

desks are that (1) they relieve the strain on the eyes, (2) they minimise the strain on the spine, (3) they enable the lungs to have a freer play,

(4) they provide facilities for change of position for successive lessons, inasmuch as the scholars may work alternately sitting and standing, and (5) *where adult evening work* is carried on in elementary and secondary schools, men and women of from 20 to 30 and upwards have not to be squeezed into a low fixed desk built for children, but may get a desk of a suitable height.

I had intended to deal with the question of school furniture only and to end there, but there are one or two other matters noticeable in certain Swiss class-rooms which may be of interest to you.

To facilitate the sweeping and cleaning of the floors of the class-rooms, and especially is this the case at Geneva, the desks are mounted on parallel forged iron rails, and can be run backwards and forwards across the room



Class-room No. 1.

on rollers (some inches in length, but not very thick) placed underneath the wrought-iron casing. The caretaker can thus easily push the desks in rows to either side of the room, and thoroughly wash or brush the floor without difficulty or obstacle.

To deaden sound and facilitate washing, a species of cork linoleum has been fixed to the floor in several schools recently erected, the cracks being filled in to give an unbroken surface from wall to wall. A strip of wood runs round the skirt-board to prevent dust from accumulating between and underneath the linoleum and the wall around the room. In schools just approaching completion, a flooring, which is a species of concrete in which a hard wood is the principal ingredient, is being tried by the architect.

All boards in the schools are of a deep brown colour—a colour approved by Swiss oculists, because it reduces reflection and is restful to the eye. The tops of all desks are coloured dark brown; the iron work is black. The walls are painted a water green (*vert d'eau*), so that they can be washed. The wainscoting of granite (crushed small and in three sizes —Nos. 1, 2, and 3), set in cement mortar, is also painted water green, but of a slightly darker tone. The blinds are water green in shade, and are pulled or pushed *up* from the bottom of the windows. On the sunny side a second blind, a white one, is added; this white blind is placed between the green blind and the window, and is pulled *down* from the top. It is used to exclude the direct rays of the sun.

A person on entering a class-room in Geneva experiences a pleasing and restful feeling to the senses from this combination of colour.

Class-room No. 2.

There is one other interesting item which I may perhaps mention, and it is that the floor of the gymnasium—and a gymnasium is attached to each Elementary as well as to each Secondary School—is of cork parquet, treated with a preparation which prevents the feet from slipping on the impact. This cork flooring is easily renewed where it becomes worn, and has been introduced to reduce the jar on the boys and girls, and to minimise and almost obviate dust and noise during the exercises.

The aim kept steadily in view throughout the construction of the building is the avoidance of the collection of dust.

In conclusion, I would venture to suggest to Educational Authorities that they should at least carefully consider the question of adjustable

"hygienic" desks and seats, and let us hope, should any arrive at the conclusion that it is desirable, from the point of view of national physique, to adopt such desks, that such Educational Authorities will not decide against the introduction of adjustable desks into schools simply because of the comparatively small extra cost necessarily involved.

Even the most economically minded of the authorities who are convinced, might decide to furnish, with adjustable desks and seats at least,

(*a*) The two or three class-rooms in such of the *elementary schools* used for evening school purposes *by adults;* and

(*b*) All the class-rooms in secondary and technical schools which are used for ordinary class-teaching purposes, as it becomes necessary to refurnish.

Many authorities under the powers of recent Education Acts, will have to consider the absence or deficiency of provision for pupil teachers, secondary (boys and girls) and technical education in their respective areas, and will, I have no doubt, be led to the conviction that new schools must be built, and existing ones extended to meet the needs of many town and country districts in the above respects, and here I venture to throw out the suggestion that

(*a*) By the addition to the main building of a few specially technical rooms, and

(*b*) By the adoption of furniture adjustable for use by children and adults,

a new secondary school for boys or (and) girls may be planned to largely meet the three-fold needs of pupil teacher centre and secondary school during the day, and of technical school during the evening. The idea of erecting such a combined building to meet the needs of the three classes of students, may make the provision of the building appear more immediately urgent and therefore possible of realisation, in certain districts where the needs of any one class might not appeal sufficiently to the general public of the district with whom, of course, rests the ultimate provision of the necessary funds.

[*This Discussion applies also to the Papers by* Dr. Thomas Wood (2) *and* Miss Alice Ravenhill.]

Dr. A. Newsholme (Brighton) observed that before any advance could be made teachers themselves required instruction, particularly pupil teachers, to whom

hygiene must be thoroughly taught. There could be no doubt that the principles of health should be taught in the school-room, but that ought to be a comparatively simple matter. Ventilation drill might be usefully adopted in the schools, the children taking turns in opening and closing windows, doors, &c., the reasons being given why these operations were necessary. So, too, with the taking of the temperature. Each child should in turn report the reading of the thermometer, and an explanation should be given whenever it was necessary to raise or lower the temperature of the room. Something might also be done in the way of scrubbing and dusting and cleaning the schools by the pupils themselves, and perhaps that might result in a diminution of expenditure, but that was a minor point. The great point was to raise a body of public opinion in favour of cleanliness, an opinion such as existed in some of the rural districts and villages, where the person whose cottage was not thoroughly clean was despised by the community. In crowded cities this sort of public opinion was less pronounced and had less weight, and it therefore seemed that it was necessary to re-educate the dwellers in the poor districts of towns and cities as to the value of simple cleanliness. In regard to school desks, they would be making a great mistake in condemning all school furniture merely because it was old. He inclined to the view that a frequent change of posture on the part of the pupils would counteract or at least minimise the evils arising from even the worst furniture. There must be no dual authority in this important administrative work; the medical officer of health must be at the head and responsible for the school hygiene as for all other departments of the public health. That rule, however, might not apply in the case of such large places as London, but for smaller communities it held good. Care had to be taken that the school-room did not become a centre of infection, and it was in his opinion imperative that there should be one central authority, with the several departments working in harmony for the accomplishment of one common object.

The President (Professor Edgar) invited expression of opinion on the possibility of harm arising from the bad posture assumed by children at home when doing their lessons. He referred particularly to children in secondary schools, who had to prepare home lessons that required three or four hours' close application, and these pupils frequently worked in a close sitting-room, on chairs ill-adapted to growing boys and girls. Public attention might well be directed to this home detail.

Dr. James Kerr (L.C.C. Education Committee) pointed out that Miss Ravenhill had now shadowed forth a syllabus for hygienic teaching in schools, and no doubt in future years the subject would have an important place in educational work. He would, however, like to reiterate what Dr. Newsholme had so well said—that expert teachers on the subject are neither necessary nor

desirable. The principles underlying the subject were easily understood and explained, and the real essential was a constant carefulness that the simple and elementary laws of hygiene were not lost sight of. The hygienic condition of the schools themselves must remain under the control of the medical officer of health for the district, and he did not think the question of controlling contagious diseases was one for the school doctor, but for the medical officer of health and the officers of the Public Health Department. Dual desks were positively bad, there could be no doubt as to that, and they should be replaced where possible. With three sets of seats and desks for the ordinary standards they could fit 95 per cent. of ordinary children, and he should be rather inclined to say that adjustable desks were a needless if not useless expenditure. In London no great attention was being given to the desk question, and all the furniture fitted fairly well, but the teachers did not seem to know how the children ought to sit. He considered that the whole question of defective eyesight was closely associated with the school-room, and particularly the infant-room. All minute and fine work should be eliminated from the infant departments, and the children should be made to write and figure on a large scale and as far from the eye as possible. There should be no stooping over small work; let them work on boards rather than on slates or paper, and in this direction, he believed, lay the solution of the problem of defective eyesight.

Dr. R. H. Crowley (Bradford) pointed out that it was a difficult matter to determine how much time should be allotted to the various subjects in the time-table, and that it was not an easy matter to introduce an entirely new subject into an already overcrowded curriculum. There was no doubt, however, that teachers ought to get more training in hygiene. It was somewhat difficult to impress people with the importance of the matter, because one could not necessarily demonstrate the actual harm being done, say, by a seat two inches too high for a pupil, or by subjecting a pupil to a long physical strain. As to the construction of many of their present school buildings, nothing could be done unless they were pulled down, and this would entail great expense upon the community. But something might be done to improve the internal condition of most school buildings. In Bradford the floors of their schools were washed once a month, and the walls whitewashed once every three or four years. Again, he thought there was a limit to what the teachers could accomplish, and if they were to be asked to take physical records of children, to observe more closely individual children, and to take more interest in the subject of hygiene generally it would be necessary to relieve them of much of the clerical work which now fell to their lot, and this would involve the appointment of secretaries for groups of schools.

Mr. G. W. Alexander (Clerk to the Glasgow School Board) remarked that

what Dr. Kerr had said in regard to school desks applied only to day schools. Mr. Graham had been considering in his paper the difficulties of the situation where the same desks had to serve for both day and evening classes, and in his valuable paper the only omission had been as to the probable cost of the adjustable seats. At Nuremberg he had seen some very elaborate desks which served both for the day pupil and the evening scholar.

Mr. A. F. Somerville (Somerset County Council) regretted that so little mention had been made of the educational authorities who were interested in the great question of school hygiene. As a member of a County Education Committee his experience was that when the members of the authority were most anxious to give their attention to such a question as that of hygiene, it was apt to be lost sight of or shelved owing to the plethora of clerical work that had to be undertaken. He confessed to having no sympathy with the speaker who had suggested that old desks should be retained in our schools, and that any evils arising from their use could be minimised by physical exercises. They might with equal justification suggest that defective drainage should be kept, and repair the consequent ills by hospitals and convalescent homes. There was a good opportunity when new schools were being built of selecting the most suitable desks and doing everything that was likely to promote the hygienic condition of the schools. He thought it would be a distinct advantage if they could educate school inspectors to the point of at least understanding something of the principles of hygiene, for at present it was too often the case that one inspector gave one set of instructions and another came immediately after with quite opposite directions. Educational authorities needed converting to the truth that a healthy body is necessary for a healthy mind. He differed from Dr. Kerr on one point, and believed that the question of school furniture was of prime importance, because undoubtedly much of the spinal trouble to which girls were liable could be attributed to the wrong position in which they sat at their work, and this was due in a great measure to bad school desks. That was a point on which he could speak from experience, and in any case there could not be a doubt that the better the hygienic conditions of a school the better the work that might be looked for from the scholars.

Councillor J. Cameron (Montrose), as a member of a School Board, was in hearty sympathy with what had fallen from Mr. Somerville. Educational authorities were face to face with the difficult problem of how to adapt the day schools for evening work, and therefore he could not agree with Dr. Kerr that the desk question was not of vital importance. Unfortunately, the question was largely one of expenditure, and although School Boards were willing to do something in the way of improvement, there was much need for educating public opinion in the general subject of school hygiene. Stooping and round shoulders

were only too common evils, and when girls and lads after a hard day's work were attending an evening class they were very apt to assume wrong postures induced by ill-adapted desks. For this reason he thought that a good and inexpensive adjustable desk was urgently required. He quite agreed, too, with the last speaker that they should pay little or no attention to the suggestions of H. M. inspectors if they were to study at least the good of the school, and also indeed in this respect the good of the ratepayers. He had known of a School Board being asked by one of these inspectors to patch and repair an old building, and immediately after the work had been done at very considerable expense they had been ordered to pull down the whole erection. The question of home lessons was of more importance than appeared at first sight. He had frequently gone into the homes of the upper classes to find the children plodding at lessons often in bad postures and in by no means ideal conditions as regarded light and air. The children were as a rule left to themselves, and sat in various attitudes for hours at a stretch, so that for this reason he would be inclined to advocate the entire abolition of home lessons, and to suggest that all necessary preparation be done in the school under the superintendence of the teachers and at desks suited for hygienic posture. Type-writing as a subject of study in evening schools was very popular, but the desk of a day school was but ill-adapted for that important branch of commercial education. The same thing might be said of sewing, and he felt that it was neither right nor just to cramp up in those seats young people who had almost reached maturity. Of course, the ratepayers had to be considered in these matters, but he believed that on the whole there was a general awakening of public opinion in the right direction.

Alderman Strange (Eastbourne) observed that it was a regrettable fact that although experts might devise great improvements in the matter of school furniture, the cheapest would be adopted rather than the best. With the last speaker, he was entirely opposed to home lessons. It was his experience that home-work was a device for forcing on and overworking clever boys and girls in their early years, with the result that they were what might be called used up before they reached the stern realities of life.

Mr. J. Graham, in reply, explained that he was not able to give the cost of the desks shown in his diagrams, but he believed they were being made in Leeds for about three fourths the price paid in Switzerland, where he had seen them in use. His object had been to devise a desk that would be serviceable both in day schools and for evening classes, and a desk that could be adjusted to either class of pupils. Dr. Kerr had been looking at the question from the point of view of the day school alone, which was a much simpler matter, and possibly that circumstance accounted for the difference of opinion. In the adjustable desks children could move quite freely, and it was not at all a case of putting

a child into a fixed position. There was great need for reformation, but a stern body of opposition had to be overcome.*

Alderman T. P. Griffiths (Southport) expressed the firm opinion that in order to secure efficient education in every respect there must be harmonious co-operation between the local educational authorities and the teachers. Whenever alterations were being made in school buildings it was important to get the best possible desks, and in all new schools that should be done at any cost, and in a short time matters would begin to improve. As Dr. Kerr had pointed out, most of the evils arising from badly suited desks and wrong postures could be traced to the infants' room, where a remedy for the whole difficulty might be found. If the children in their very early days were taught how to sit correctly, and impressed with the necessity of doing so, and if simple hygienic teaching were there introduced, gradually there would be built up a system that would be of immense benefit to the country, and tend to promote the increased prosperity and welfare of the nation.

Dr. T. Simpson (Liverpool) said that stooping is an evil custom which leads to many serious results, and therefore he believed it was necessary to adapt school desks to the requirements of different pupils. If dual desks were bad, then single ones should be supplied, but there really ought to be no difference of opinion as to the necessity for taking steps to put an end to anything that is injuring the well-being and the health of the children.

Mr. C. Breach (Eastbourne) gave a short but interesting outline of what was being done in his town to improve the hygienic condition of the schools and their pupils, and expressed the view that local authorities would be justified in paying less attention to cheapness in the matter of school furnishing, and a little more to actual requirements and needs. The proper lighting and ventilation of school-rooms meant healthy children, and this was a principle that went to the roots of the existence of a nation.

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* Mr. Graham subsequently forwarded the following particulars with regard to the cost of the desks shown in his diagrams, viz., Kindergarten Dual Desk and Seat costs about 23s., Elementary Dual Desk costs about 25s. 6d., Technical Desk costs about 32s. 6d., Engineering Table costs about 70s., Single Desk for Secondary Schools, without locker or seat, costs about 35s., Single Desk for Secondary Schools with locker, no seat, costs about 40s., an Adjustable Seat, single pedestal, rise 4 inch. seat, and 2 inch. back rail, costs about 14s.

PHYSICAL TRAINING AS A BRANCH OF SCHOOL HYGIENE.

By ALAN TUKE, M.B.

ABSTRACT.

"THE primary object of any course of Physical Exercises in Schools is to maintain, and, if possible, improve the health and physique of the children."

This is the opening sentence of the new model course of physical exercises, lately drawn up by an inter-departmental committee. This committee further states that: "The question of physical training can only be looked upon as a branch of the greater question of School Hygiene." These two findings are of the greatest importance, showing that the educational authorities are now cognisant of the necessity of physical training as a part of the regular school life of the children, and they are my reason for the subject of this paper.

I wish to deal with the health and physique of the children attainable by systematic muscular exercise. This can be termed its physical effect.

In working to produce the physical effect, there should be three distinct aims in view:—

To raise the standard of health, and hence increase the power of resistance to the organisms of disease.

To assist in the treatment of distinctly pathological conditions.

To aid the development of the child in structure and function.

Muscular exercise affects the general nutrition of the body. The first and immediate result of muscular contraction is to raise the blood pressure, and in consequence to increase the exudation of the lymph (the food in an assimilative form) into the general tissues of the body. In the actual muscle itself there is an effusion of lymph, not only at the time of contraction, but immediately after it has ceased. Dr. Oliver, of Harrogate, to whom we owe much of our recent knowledge on this subject, has clearly demonstrated that a muscular contraction of sixty seconds produces these two effusions; the one at the time of contraction is absorbed in sixty seconds, and the one that follows contraction is as

quickly taken up: so that in four minutes there are two effusions which are entirely absorbed. Further, during muscular contraction pressure is exercised on the lymphatic vessels, which aids the flow of the lymph.

From the above we can gather that muscular exercise hastens the flow of the lymph by two routes:—

By the direct effusion from the blood into the tissues (the short route);

By the lymphatic vessels (the long route).

So that during muscular exercise, and immediately following, there is a high level of lymph-exudation maintained, and the lymph-spaces of the tissues are filled with lymph, which means an increased supply of food and oxygen to those tissues, and a corresponding removal of waste products. The physiological principle on which these exercises are based, is that short muscular exercise stimulates the fluid exchange between the blood and the lymph spaces. "*Nutritive*" is an excellent name to apply to these exercises, because it at once conveys to the mind exactly what the object of the exercise is, to nourish and build up the body.

Now we know that to get the physiological value of these exercises they only require to be of sixty seconds' duration to produce a four minutes' result; hence their value and general applicability, because they can be used on the healthy and feeble alike. Surely no child able to walk to school is unfit to undergo a minute's short and sharp muscular exercise, although it is repeated hourly during the school day.

In Sweden the method used is *each hour* to turn the children into the playground for ten minutes, and under supervision to see that they engage in skipping, jumping, and quick-running games. Practically all that is required is any coarse muscular movement, as long as it is done with moderate regularity for sixty seconds once during each hour. Exercises of the trunk and lower limbs are valuable because of the large amount of muscle brought into action. Precision of movement and correct position are of no value; it would be quite against the physiological principle of the exercise to stop the movement to correct either of these, The advantages from a school point of view are that the exercises can be carried out without interfering with the school work; the children only require to stand up at their desks. The teaching power of the instructor need only be of the most elementary kind, and his attention can be solely directed to see that all engage in the work.

There is another class of exercises, the respiratory, or deep breathing, which are very distinctly of the nutritive order. They directly aid the nutrition of the body by bringing to the blood an increased supply of oxygen and removing the carbonic acid gas; they develop the air-cells of

the lungs in ordinary use; and, further, the forced inspiratory effort gets at many of the air-cells not brought into play in ordinary respiration. They are an important factor in keeping up the nutrition of the lungs. Their effect on the circulation is just as important, as they markedly improve the nutrition of the heart-muscle; and an improved heart muscle means greater blood-pressure, and consequently increased fluid exchange between the blood and the tissues.

The Deep Breathing Exercises consist of long, deep inspirations, followed immediately by prolonged expiration, breathing done through the nose only. It is wise to commence gradually, and not to aim to get the fullest respiratory movement possible at once, but from day to day to gradually prolong both inspiration and expiration. An excellent method is to combine with the purely respiratory exercises such of the arm-and-body movements as tend to intensify both the inspiratory and expiratory acts.

This type of nutritive exercise should be used at least three times during the school-day. It is hardly necessary to add that their benefit is enhanced if done in the open air.

The second aim, to assist in the treatment of distinctively pathological conditions, is one that in this country has never received that attention to which, I think, it is justly entitled. In every school one is struck with the fact that there is a certain percentage of the children who, from some physical defect, are unable to take part in the games of the playground, and who are to be seen moping in corners, or hanging about the class-rooms during the play-intervals; and when instruction in physical training is going on, and their fellow scholars are improving their physical health, these unfortunates, who are most in need of improvement, are given some simple educational task to keep them out of mischief.

Surely if physical training by muscular exercise is looked on now as essential for the healthy school child, it is more so for those suffering from bodily defects, who are shut out to a greater or lesser degree from the natural games of childhood.

The New Code suggests that the weakly children be placed at the rear of the class, to do such part of the exercises as they are fit. This has been commented on adversely by the *British Medical Journal;* but it must be kept in mind that the Code was drawn up for school-children of both sexes of average health, and was not intended to include those who are suffering from pathological conditions. The practical question is: What are we to do for these children who from bodily defects are ill-developed or malformed?

These children should be placed under medical supervision. The

medical supervisor must have under his direction teachers, both male and female, who have been specially trained in therapeutic gymnastics. By this means many defectives in the early stage may be completely cured, and the more advanced greatly benefited and given the opportunity of becoming useful citizens.

I do not think that there can be any great diversity of opinion as to the advantage of medical supervision and examination of all school-children, and the necessity of it if remedial gymnastics be taken up as a part of the school curriculum. Periodical medical examination would bring to light many of these pathological conditions, which are not to be recognised except by an expert. In certain pathological conditions of the heart and lungs, carefully graduated muscular exercise is of great and well-known value; but, their indiscriminate use may produce most untoward results. All that should be asked of the teacher is to bring under the notice of the school medical officer those pupils who, during physical training, exhibit signs of distress or discomfort. It is then for the latter to decide on what lines this branch of school hygiene is to be carried out.

Lastly, how is the effect on the physique of the children by the systematic use of physical exercises to be ultimately gauged? Is it to be by impressions gathered from instructors and teachers, or from data derived from careful and scientific observation by well-qualified medical men? I prefer the latter.

The third and last aim is to aid the development of the child in structure and function. The type of muscular exercise used with this object in view is of an entirely different character from that employed to bring about the nutritive result. It is here that the educational result is looked for as well as the physical. It is not the production of masses of muscle that should be aimed at, but to produce an even muscular development, so that the various groups of muscles may co-operate in perfect harmony, and in consequence make their action both prompt and easy. Each part of the body should be exercised in accordance with its natural function, and the muscular effort of doing so must be well within the power of the weakest member of the class. The exercises, simple to begin with, will require to be numerous. They should gradually advance in complexity, so that imperceptibly, harmony of muscular movement may be realised. Exercises of this type have a powerful influence on brain-development. At least one-third of the brain is given up to the motor areas. Each area has directly under its control certain groups of muscles, and that muscular exercise is necessary for the full development of these centres is proved by the examination of the brain in cases where a limb

has been lost in early life, the corresponding motor-areas of which are found to be but feebly developed.

Instruction to attain this aim of physical training must be carried out in the form of an educational lesson, each lesson lasting about thirty minutes, and should be repeated about three times weekly. In no branch of school work is able instruction more essential. As a rule there is no attempt made to present this subject to the teacher from its physiological aspect. A training, to be of any real use, must include instruction in the theory of the Physiology of Exercise, as well as in practical work. In the training colleges for teachers I think that school hygiene, in all its branches, is fairly entitled to find a place.

There are many men, commonly known as gymnastic instructors, who have taken up physical training as a profession. Of this class I can see that a large number are deficient in the fundamental physiological principles of the subject.

To aid and assist all teachers, both professional and otherwise, to acquire a sound knowledge of physical training, I urge strongly the formation of a Scottish Institute of Physical Training. Such a body could establish in various centres courses of lectures, and afford opportunities to both country and town teachers for acquiring a wider and deeper grasp of this subject. It would still further tend to raise the standard of teaching were such an institution to issue certificates of proficiency after examination both in theoretical and practical work. I trust that the day of the old drill-sergeant is passed, and that in the future this work will be put in the hands of those able to appreciate it from a higher standpoint.

The question of feeding is one of great importance in the general adoption of physical training. Children may be deficiently nourished because they are getting an insufficient quantity of food, or a sufficient quantity, but of inferior quality. With the latter of these the better education of the parents will benefit, because obviously pease-meal porridge and broth are no more expensive than tea, red herrings, and pickled salmon. Can we physically train children who are obviously underfed? All that we can venture in these cases is to attempt the first, the nutritive aim: to aid the flow of the lymph, such as it is, by those one-minute exercises which can produce no fatigue and no waste. It is obviously out of the question to attempt the third aim, because the exercises with that in view would involve more prolonged muscular work, and consequently increased tissue-waste, a result to be avoided when there is nothing to fall back on to replace the loss.

The question of suitable clothing does not present any great difficulty. Boys require to take off jacket and waistcoat, and loosen the shirt at the neck. Then ordinary boots *must be replaced* by gymnastic shoes, because it is useless to attempt the foot exercises in boots with a three-quarter inch sole well studded with nails. The importance of these exercises in developing the arch of the foot, and counteracting flat foot, is great, because flat-footedness is a disability which excludes from every public service.

In girls, gymnastic shoes are just as necessary. Stays should be renounced, so as to insure the free play of the trunk muscles. A simple school costume, such as is used in Sweden, should be gradually introduced into all schools, consisting of a loose blouse, a skirt, and knickerbockers. For the purpose of physical training the skirt only is removed. Such a dress permits complete freedom of movement, and hence the better carrying out of the exercise.

The President (Professor Edgar), in thanking Dr. Tuke for his instructive address, expressed the hope that some of the delegates who were experts in this subject would give the conference the benefit of their ripe experience, particularly as regarded specialised physical training for eliminating tendencies to stammer and twitch. Something in this way might be done for those unfortunate children, liable to nervous breakdown, calculated to fall easily under the power of narcotics, and not infrequently possessed of moral peculiarities. Specialised physical training in such cases was nothing short of giving them a chance in life.

Dr. John G. Kerr (Allan Glen's School, Glasgow), speaking not as an expert but as a teacher with personal experience, said that fourteen years ago he had been appointed to a school of some 600 boys, at a time when there was not only no physical training there, but a traditional absence of such a subject. Although satisfactory work was being done in that school, he came to the conclusion that something more might be accomplished by the aid of physical exercises. The subjects of study in that establishment were mostly physics, chemistry, and mathematics, and he reasoned that if he could get a break by means of physical exercise, just at the point when the boys were becoming mentally fagged, it would freshen them up, and better work from even the schoolmaster's point of view would be done. Although somewhat out of form and practice in athletics he began training at home, and finally took charge of athletics in the school with excellent results, both to the pupils and himself.

It might be worth mentioning that, although 38 years of age at that time, he increased his chest measurement by $2\frac{1}{2}$ inches, which was somewhat remarkable. He had continued to encourage such strong but not long-sustained muscular exercises as one had in jumping, with dumb-bells, on the bar and ladder, and at the punching-ball, and had found them invaluable, both from the nutritive and the recuperative results. He had been greatly interested in Dr. Tuke's clear exposition of the lymph-flow theory. Long ago he had accepted Dr. Lagrange's conclusion that physical exercises were meant to meet what was called respiratory need, with, in immediate sequence, a marked recuperative effect. A muscle was a complicated piece of mechanism, and it was not easy to grasp fully what took place during motion, and what was the reason for certain important results.

Dr. S. G. Moore (Huddersfield) mentioned a point of which there seemed to be some tendency to lose sight, although it was really a point which should appeal to educationalists most strongly. It would not do to disturb the proper balance of subjects in a school curriculum, and educationalists must not be carried away by the claims of any particular subject, but must retain a due proportion of each in the whole curriculum. There appeared to be a possibility of this being forgotten in the matter of physical training, which was a branch of school hygiene, but by no means the most important branch. The health of the school was more dependent upon the observance of simple hygienic truths, which ought to be conveyed to the minds of all scholars alike, than upon anything else, and that in its broadest aspect was more important even than physical training by itself.

Dr. H. Dyer (Glasgow School Board) thought they would agree that the warning proffered by Dr. Moore was much needed, for there was a pronounced tendency to run any new subject too far. They should give physical training in schools due attention, and nothing more than its due share of the time and place in the school curriculum. He opined that instruction in the simple facts of hygiene was more important than a set scientific course. Of course he was not opposed to physical training in schools, but there was another danger which ought to be perceived, *i.e.*, the tendency for boys and girls of the present generation to give up, in favour of special forms of physical exercises and training, those old traditional pastimes, the simple healthy games in the open air which were common thirty years ago, and which conferred benefits similar to those of the modern style of physical training. He believed that an attempt was being made to reintroduce the skipping-rope into fashionable circles as a valuable exercise, and it was to amusements of that kind that he referred as being partly discarded by the school children of the present generation. While he hoped that due attention would be paid to physical training in schools, he should regret if there was any discouragement of the national training obtained from the old-time amusements of boys and girls.

Miss Alice Ravenhill (London) said that Dr. Tuke had mentioned skipping in his paper as a valuable form of physical exercise; but where, unless in schools, was there accommodation for skipping? Not, certainly, in the crowded streets; but there was an even more serious drawback than that. Owing to the conditions of city life many children were devitalized, habitually languid, and really incapable of taking the necessary amount of physical exercise. Such children might be reached and helped by physical training in the school. She had seen most excellent results in the United States by combining instruction in the simple rules of health with physical drill, and she would advocate the adoption of a somewhat similar plan for this country. She did not by any means wish children to become introspective, but merely to take an intelligent interest, for instance, in chest expansion and ordinary physical development. That would be a great step towards the realization of the ideal of combining and harmonising the action of the mind and of the body.

The President (Professor Edgar) admitted possessing the utmost sympathy with the encouragement of the old open-air games, and if his voice could be heard throughout Glasgow, he would plead for funds to buy playgrounds for the children. It was, he thought, simply scandalous that many of their ancient institutions should be seriously handicapped in this matter, and that the generosity of the founders had not been followed up at the present day by sufficient liberality to ensure these institutions having open spaces and playgrounds around them. If children were to be strong enough to stand the stress and the strain of modern life, they must have easy access to open spaces and playing fields during their growing years, and it was the duty of a city of the wealth of Glasgow to see what further could be done in this intensely practical direction.

Councillor J. Cameron (Montrose School Board) said Dr. Tuke had properly advocated the need of some physiological knowledge on the part of the drill inspector, for what he found was that the drill inspector was too zealous, too fond of results, and required adequate supervision. All children should not be compelled to take the same exercises—they were not all bodily capable of receiving the same training—and the attainment of perfect precision was not the main object of physical drill. The simple games of childhood were as a rule admirable, and he should specially like to say a word in favour of swimming, which was a desirable form of physical training in seaport towns. In fact, he thought that any amusement or recreation should be encouraged which tended to strengthen and develop the bodily frames of the rising generation, and it was upon this ground that he had occasionally been inclined to advocate dancing as a form of physical training. If it were true that the Highland soldier got his first idea of bravery and courage in the playgrounds of the Highland schools, it was surely legitimate and necessary that something should also

be done for the less fortunately placed child of the city, who was often physically unfit to benefit from the great educational advantages placed before him.

Mr. W. J. Abel (Nottingham) explained his conviction that the teacher is the key to the whole position. His experience was that there had been and still was a serious danger of relying too much on external appliances in physical training, with the result that scholars often suffered more than they benefited by the exercises in a gymnasium. In Nottingham, for instance, they had largely discarded their specially fitted gymnasia, and were relying mainly upon free exercises. The teachers should understand the reason for those exercises, and then better results would be obtained by entrusting the physical instruction to them than by employing special and expert drill instructors. The ordinary teacher was much more likely to adapt the exercises to the needs and the capacities of the scholars. Hence, the first thing really to be aimed at was to educate the teacher, and particularly to teach him the reasons for the things that were done, and then to draw up, with the aid of the teacher, a suitable course for the children.

Mr. J. Kent (Paisley School Board) urged that there should be greater facilities provided for the children to exercise themselves in what he might call the rational pastimes. Many of the present schools had little or no playground space, and the circumscribed areas which they might possess were only open for the children during school hours. This was not only a distinct hardship to the children, but also a national loss. Educational bodies and municipalities, however wealthy, were not able to do enough in that direction, and they must therefore look to the wealthy citizen to assist them in the good work of giving the children a chance of becoming healthy and strong men and women in the future. Too often the street was the only playground available for the children, and he regretfully had to admit that such was the case in Paisley. The result was that trouble followed and frequently children reached the police-court, where it would be difficult to say whether culprit or magistrate was in the less enviable position. It was distinctly unjust that a child should be punished for playing in the street when no open space or playground was available.

SCHOOL HYGIENE.

A Plea for Compulsory Teaching of the Elementary Principles of Hygiene in all Public Schools, and a Brief Outline of what might be taught.

By J. F. BUTLER-HOGAN, B.A., M.D., LL.B., D.P.H.

Ex-Chairman, Teaching Staff Committee, Leyton School Board; Medical Officer of Health, Tottenham.

(MEMBER.)

ABSTRACT.

HOW to live is the most important lesson that can possibly be instilled into the minds of the rising generation, and yet hitherto such teaching has found no recognised place in the large and varied curriculum of our elementary schools. If we are to fight successfully the ogre of consumption, or the demon of smallpox, or indeed any of the infectious diseases which create such havoc in our midst, we must avail ourselves of the elementary schools as a necessary medium for the education of the lay mind on such matters.

In insisting upon the compulsory instruction of school children in hygiene we should confine ourselves to the elementary principles, and only attempt to teach that which is absolutely necessary, and at the same time only what it is quite possible for the children to learn. The following are the definite points which should be made interesting and intelligible to all.

The value of cleanliness and pure air.—This would include a practical knowledge of the proper ventilation of homes by night as well as by day, a clear understanding of how air may be vitiated by imperfect drainage, and the recognition of bad smells as warnings of danger.

The composition and simple cooking of food.—This would include an experimental knowledge of starch, fat, sugar, albumen, fibrine, gluten, casein, mineral salts, in the different materials used as food, and an appreciation of the way in which nature uses them to build up the bodily organism.

The need of pure water and the danger of alcohol, or with the stimulating effects of other drinks, such as tea, coffee, &c., and the nourishing nature of milk, cocoa, &c.

The general control of child life, mental and physical. This would include the feeding of babies, regulation of steady and leisure work and rest. The value of home life in its comforts and beauty, and the rational use of clothing.

The detection of the first symptoms of illness and the preliminary steps for isolating infectious cases. This would include a practical knowledge of the standard of health and development that may be obtained under certain circumstances.

Mr. W. J. Abel (Nottingham) observed that in order to provide places for the children to play in, the Nottingham Education Committee opened a number of their school playgrounds out of school hours, and that the Corporation paid the caretakers of such schools 3s. per week for the extra work and responsibility incurred.

Mr. W. Graham (Glasgow School Board) explained that the School Board of Glasgow had some 70 or 80 playgrounds, the bulk of which were thrown open to the children of the localities in the afternoons, and through the influence of Mr. Bailie Anderson the Corporation had erected gymnasia in three of the schools, and they were negotiating at present for similar provision in several of the others. These were of great advantage to the children in the localities of the schools, and though there were accidents occasionally these were not serious. Most of the school playgrounds were also open on Saturdays, and similar arrangements would be found of great advantage to the children of other towns.

Mr. J. Fallows (Liverpool) pointed out that the author advocated three chief classes of foods for children, and although he gave the principles of each, did not say how those principles could best be extracted from the food supplied. This was something like telling a person there was mineral in a mine, but omitting to give the information as to how that wealth could be extracted. The point here was how could a child best obtain the beneficial part from the substances. This suggested the importance of cooking, and a knowledge of the changes which food undergoes in the process of cooking. He remembered a desperate attempt he once made to take porridge, which was nauseous, the reason being that it was not properly cooked. He believed one reason why cookery classes were not so favourably received as they ought to be, was because the children were not taught the changes effected in food by the process of cooking, the changes which occur through the application of heat.

His point would be made clear by his experience with the oatmeal, which now being cooked properly was relished by the youngest child in his family. The popular way of making porridge was to pour boiling water on the oatmeal, and then let it boil for a certain length of time. This was wrong. The food substances should be allowed to soak so that the starch granules swell out; this should be done for four or five hours before subjecting the oatmeal to cooking from the cold to the boiling point, instead of commencing with the boiling point. Another point with regard to cookery classes was the elaborate arrangements and utensils that were used, which it was impossible for a child to get at home. When the child came to do some of the things she was supposed to have learnt at the classes she could not get on because she had not got her scales and measures and so on, and could not use the ordinary domestic utensils on the rule of thumb principle. By practically working in the home they learnt to do things which they could never have learnt in a class. The discussion as to whether vegetable or flesh food is best seemed to be partly raised in this paper, and all he could say with regard to a vegetable diet was that if this was to be enforced with children, their intestines would have to be greatly extended. It seemed to be evident that those nations which subsisted mostly upon flesh food could endure greater hardships and perform more work than those nations living chiefly on vegetable foods. Of course, he knew the point was greatly in dispute, but he thought they should teach the children to find out for themselves which kind of food agreed with them best, and which form of diet could best be assimilated. As to the supper question, he strongly objected to children having suppers at all. If a child had a suitable late dinner, that was sufficient to last till the following morning. If they went to bed with a full stomach the chances were that they would not get a night's rest.

OBITUARY.

GEORGE VIVIAN POORE, M.D.Lond., F.R.C.P.

By the death of Dr. George Vivian Poore, sanitarians, in common with the medical profession and the public, have sustained a very heavy loss. Dr. Poore's contributions to sanitary science and practice were in their way unique. He was able to survey the ground from the point of view of a general physician and a man of science, unhampered by the controlling and sometimes deadening influences which environ the man who is engaged in public health administration. To some extent Dr. Poore was a free lance in the sanitary world, but his excursions into the territory of hygiene were always welcome to those actually engaged in sanitary practice, not alone for the sparkle and brightness which were characteristic no less of his writings than of his speeches, but for the truths and happy definitions which his writings contain, such truths, especially when they are of an elemental nature, being too often apt to be buried and lost sight of in the progress and development of a young and aspiring science.

The inner meaning of much of Dr. Poore's work in the department of hygiene may be expressed in the words "Is not our daily life becoming too complex? Would it not be better to return to nature? If so, how is it to be done?" The "Essays on Rural Hygiene," "The Earth in Relation to the Preservation or Destruction of Contagion" (Milroy Lectures), "The Shortcomings of some Modern Sanitary Methods," and many other contributions develop this, the central idea of much of Dr. Poore's work. But he was not merely content to advocate his views on theoretical grounds, he also practised himself the principles he enunciated; and his house at Isleworth, and later on his garden at Priory Lodge, Andover, demonstrated to all who chose to observe how the individual citizen, who has a house and curtilage, may, by thought and care and the observance of nature's laws, be independent of complicated sanitary fittings, such as waterclosets, drains, and sewers, and may even dispense with the periodical visits of the dustman.

Dr. Poore was a faithful disciple of the Rev. Henry Moule. He had a strong belief, which in him amounted to a conviction, that the surface soil of the earth was nature's chief purifying agent. He made a very careful

study of the purifying powers of different kinds of soil, and he arrived at the conclusion that under suitable conditions, and with intelligent manipulation, surface soil was the best of all purifiers for the waste and refuse matters of the human body and of human habitations.

In his advocacy of the more general practice by the community of conservancy or dry methods of excretal removal and disposal, and the purification of waste waters on garden ground, Dr. Poore, like other gifted men, was apt to lose sight of the fact that the science which interested him was of little account to the ordinary individual, and that the expert knowledge and intelligence which he could bring to bear upon the subject of refuse disposal were totally absent from the mental equipment of the ordinary householder. The man who is actively engaged in public health duties very soon realises how apathetic the public is in all sanitary matters, and that any system which depends for its success on even the smalles modicum of care and intelligent application on the part of the great mass of the population, is bound to be a failure, because neglect and unintelligent use are certain to follow. A return to the simple life, in which every man is his own scavenger, is possible enough to men of Dr. Poore's stamp, but the great bulk of the population, if they are to remain clean and have sanitary homes, must have everything made so easy for them, that no thought or care is required on their part, and even their mistakes and misdoings must be capable of easy rectification.

Dr. Poore was a man, however, who did not confine himself to one particular subject. He studied, he travelled, and he observed; and whatever the matter which he had at any time in hand, his observations upon it were always shrewd and far-seeing, and well worthy of attention. Of his success as a hospital physician and teacher it is not incumbent upon me to dilate in this notice; but of his really remarkable powers of forceful exposition as a lecturer or debater or speaker at meetings, it may truly be said that they were gifts of a quite unusual kind. When Dr. Poore rose to speak, there was always a pleasurable anticipation amongst his audience that they were about to listen to a really good speech, well reasoned, clearly and forcibly expressed in resonant tones, and lightened by those occasional touches of fancy and humour which were hardly ever absent from his utterances. Nor were his audiences ever disappointed; and Dr. Poore also did much towards the entertainment of the company at public dinners, where the after-dinner oratory is not always of the kind suitable to the occasion.

Dr. Poore was one of the founders of the Parkes Museum, and he took the very greatest interest in it from its earliest days. He was

honorary secretary of the Parkes Museum from 1876–1882, and it is very largely due to his efforts and his appreciation of what the future of the Museum would be, that the undertaking did not perish of neglect and want of support in its infancy. From 1883–1888 Dr. Poore was vice-chairman of the Parkes Museum, when Sir Douglas Galton was chairman, and he was later on a member of council of The Sanitary Institute, and registrar in 1902–3.

He frequently attended the congresses of the Institute, and he read numerous papers at congresses and sessional meetings. He was, up to the last, much interested in the work of the Institute, and his death now removes nearly the last of the pioneers of the "seventies," who underwent the struggle and strife of rearing the Parkes Museum and Royal Sanitary Institute on their present foundations, and of awakening the interest of a very apathetic public in schemes designed for the public's own well-being and sanitary improvement.

In private life Dr. Poore was always delightful, a most entertaining and genial companion, and a true and trusty friend; there must be a great many who will deplore his departure from amongst us.

L. C. P.

A Portrait of Dr. Poore *forms the frontispiece to this Part, facing p. 385.*

DECISIONS OF COUNCIL ON RESOLUTIONS PASSED AT GLASGOW CONGRESS.

Recommendation made in Section I.—

"That in view of the prevalence of pulmonary tuberculosis in the population of Great Britain, and of the suffering, pauperism, and death resulting from the dissemination of that disease, this Congress recommends the Council of The Sanitary Institute to memorialise the Local Government Boards of England and Scotland to allow Local Health Authorities to make pulmonary tuberculosis a compulsory notifiable disease, on such conditions as may be approved by the Local Government Boards."

The Council have communicated with the National Society for the Prevention of Tuberculosis with a view to joining in such action that this Society may be taking with regard to preventing the spread of this disease.

Recommendation made in Section II.—

"That this meeting is of opinion that the whole question of water supplies demands investigation by a Royal Commission appointed specially to deal with that subject, and recommends the Council of The Sanitary Institute that representations be made to the Government accordingly."

The Council decided to approve and adopt this resolution, and to forward a copy to the Local Government Board.

Recommendations made in the Conference of Medical Officers of Health—

"That this Congress is of opinion that the public health has suffered seriously through the transmission of smallpox by tramps, and recommends the Council of The Sanitary Institute to petition Parliament to take such measures as will place vagrants under control, and reduce the risks of their disseminating infection."

The Council decided to approve and adopt this resolution, and to send a copy to the Local Government Board, with the suggestion that the control referred to should include vaccination, re-vaccination, and detention. Also to send a copy of the resolution with the same suggestion to be brought forward on behalf of the Institute at the Conference arranged

by the London County Council on the spread of infectious diseases by vagrants.

> "That in the opinion of this Conference, no female Sanitary Inspector or Health Visitor should hereafter be appointed by a Local Authority unless she has previously obtained one of the recognised qualifying certificates for a sanitary inspectorship; and this Conference recommends the Council of The Sanitary Institute to take such action in the matter as may be found desirable."

As the question in this resolution will probably be dealt with in the near future by an amendment of the Public Health Acts, the Council decided not to take any action at present.

Recommendation made in the Conference of Engineers and Surveyors—

> "That this Conference is of opinion that the advent and increase of motor vehicles on public highways renders it imperative, in the interests of public health, that Municipal, Urban, and County Authorities should adopt methods for the prevention of dust during dry weather on macadamised roads, and this meeting recommends the Council of The Sanitary Institute to make known this view as widely as practicable."

This resolution is so mixed up with questions of finance that the Council do not think it desirable to take any action with reference to it at the present time.

Recommendations made in the Conference of Sanitary Inspectors—

> "That this Conference of Sanitary Inspectors, representing Members and Associates of The Sanitary Institute, has learned with great regret the decision of the Council with regard to the several resolutions passed at Bradford in 1903, and respectfully requests the Council will at once reconsider these, with a view to the unanimous opinion of the Conference being adopted in each case."

This resolution appears to refer to the question of admitting Sanitary Inspectors to membership. The Council desire to state that there is no rule to prevent Sanitary Inspectors whose qualifications are considered sufficient by the Council from being elected as members. Each application will be considered on its merits.

> "That this Conference of Sanitary Inspectors is satisfied that the manufacture and sale of common unwashed wool-flocks for bedding, furniture, and cushion stuffing should, in the interests of public health, be disallowed by statute, and they request the Council of The

Sanitary Institute to take the whole question of the use of this unwholesome and filthy material into their most serious consideration, with a view to an early representation being made to Government on the subject, in the hope that as early as possible the matter may be taken up and adequately dealt with."

The Council have addressed a communication to the Local Government Board on the subject of this resolution, urging that the whole question of unclean bedding and clothes be considered in connection with the Amendment of Public Health Acts.

"That in view of the increasing difficulties arising from accumulating Public Health Acts in England and Wales, exclusive of the Metropolis, this Conference of Sanitary Inspectors, held at Glasgow, is of opinion that immediate measures should be taken to consolidate such Acts, and to amend certain provisions which are both contradictory and inadequate, and recommends the Council of The Sanitary Institute to take such steps as may be found necessary to attain this object."

The Council decided to approve and adopt this resolution, and to forward a copy to the Local Government Board.

"That in view of the fact that property owners not infrequently increase the rents of houses after doing certain sanitary repairs, such increases often being considerably out of proportion to the amount expended, and, as these increases of rent most generally fall on occupiers of old and cheap houses, this Conference recommends the Council of The Sanitary Institute to take such steps as may be found necessary to prevent the rents of houses being increased, as follows, viz.: where the rates are compounded, the annual rent not to exceed 50 per cent. of the assessment; and where the tenants pay the rates, the annual rent not to exceed 25 per cent. of the ratable value."

This resolution appears to involve a question of political economy, and the Council do not propose to take any action.

Recommendation made in the Conference on the Hygiene of School Life—

"That it is the opinion of this Conference on School Hygiene that there should be regular and systematic medical inspection of school children, and requests that the Council of The Sanitary Institute will bring this important matter before the educational authorities of the country."

The Council propose to bring this resolution forward for consideration at the forthcoming Conference of the Institute on School Hygiene in February next.

THE ROYAL SANITARY INSTITUTE.

His Majesty the King has graciously accorded his patronage to the Institute, and has signified his pleasure that the Institute be known as "THE ROYAL SANITARY INSTITUTE."

The Council have addressed the following letter to Sir Dighton Probyn:—

SIR,

The gracious message from His Majesty the King that he will give his Patronage to the Institute has been received by the Council at a special Meeting called for the purpose with much gratification.

The Council desire humbly to thank His Majesty for this gracious favour, and to record their sense of the high honour conferred upon the Institute by this mark of approval of the public work which it has been seeking to accomplish in the United Kingdom and other parts of the Empire.

(*Signed*) NORTHUMBERLAND, *President.*
W. WHITAKER, *Chairman of Council.*
E. WHITE WALLIS, *Secretary.*

ALTERATION OF MEMORANDUM AND ARTICLES OF ASSOCIATION.

At an Extraordinary General Meeting held on Monday, October 24th, 1904, the following alterations in the Memorandum and Articles of Association were approved:

That the word "Royal" be added to the title of the Institute, and that in future the title be:—"THE ROYAL SANITARY INSTITUTE," and that any alterations necessary, consequent on such change of Title, be made in the Memorandum and Articles of the Institute, and in its By-Laws.

That without prejudice to the generality of the foregoing resolution the existing Article 13 be altered to read as follows:—

13. Any Member desiring to designate himself as belonging to the Institute as a Member thereof shall, as to Fellows, be entitled to so designate himself by the description F.R.San:I., and in the case of an Ordinary Member be entitled to so designate himself by the description M.R.San:I.

That in Article 21 the description "Assoc. San. Inst." be omitted for the purpose of inserting the description "A.R.San:I." in place thereof.

HENRY SAXON SNELL PRIZE.

THE Henry Saxon Snell Prize was founded to encourage improvements in the construction or adaptation of sanitary appliances, and is to be awarded by the Council of The Royal Sanitary Institute at intervals of three years, the funds being provided by the legacy left by the late Henry Saxon Snell, F.R.I.B.A.

The first prize, which will consist of £50 and a medal of the Institute, is offered in the year 1905 for an Essay on "Domestic Sanitary Appliances, with suggestions for their improvement."

General Conditions.

1. The Essay to consist of not more than 5,000 words, to be type-written on foolscap, one side only, and to be illustrated by drawings or sketches.

2. Two Competitors of different professions or crafts may join in sending in an Essay and Plans.

3. Essays must be delivered before 4 p.m., on or before March 30th, 1905, addressed to The Secretary of The Royal Sanitary Institute, 72, Margaret Street, W.

4. Each packet is to be clearly marked on the outside, "Henry Saxon Snell Prize," and the Competitor's motto must be legibly written on the outside of the packet at the right hand lower angle.

5. The Essays are to be submitted without the name of the competitor, but with a motto legibly marked on the right hand lower angle of the first sheet: and to be accompanied by a letter containing the competitor's name and address, which is to be inclosed in an envelope sealed with a blank seal, and having on the outside, "The Henry Saxon Snell Prize," and the same motto as that attached to the work submitted. The sealed envelope must be inclosed in another envelope and sent by post, directed to The Secretary of The Royal Sanitary Institute, 72, Margaret Street, London, W.

6. Should none of the Essays be considered of sufficient merit

or importance to deserve the Prize offered, the Council reserve the right of withholding the award.

7. In the event of two competitors of equal merit, the prize may be divided.

8. The Essay or Essays to which the prize is awarded are to become the property of the Institute.

9. The carriage of the Essays to and from the Office of the Institute, and all expenses incidental thereto, must be paid by the competitor. Unsuccessful Essays will be returned on application, on the production of a formal demand within a period to be specified after the close of the competition.

10. Due care will be taken of all Essays, but the Institute will not be responsible for any loss of, or damage to them while they remain in its keeping.

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THE ROYAL SANITARY INSTITUTE

DISCUSSION ON

INFECTIOUS FEVER HOSPITALS.

Opened by R. E. LAUDER, F.R.C.S.E., D.P.H.,
Medical Officer of Health, Southampton.

At Provincial Sessional Meeting at Southampton, October 29th, 1904.

IT is scarcely desirable to-day to consider the various and diverse opinions that have been expressed for and against the utility and continued use of infectious fever hospitals. Most observers are agreed that infectious fever cases should be isolated not only for the protection of the community but also for their treatment, especially those cases occurring in congested districts, and where circumstances do not permit of their separation from the healthy.

It is not proposed to discuss, with regard to isolation hospitals, whether the results obtained in them justify their cost, or whether they limit or check the spread of disease to a degree equal to what has been or could be expected. Such a discussion would involve figures concerning results and expenses that would confuse rather than make clear the way for the question to which I wish to direct your attention, namely:

Is the position of hospitals for infectious fevers what it ought to be in the interest of the patient as well as of the community, in the light of our knowledge of bacteriology as applied to other branches of medical work?

In considering this question, it seems advisable to look back and see what changes have been wrought in the wards of other hospitals by applying modern knowledge to their structure and administration, and learn what improvements can be accomplished by the application of similar methods in infectious fever hospitals.

Undoubtedly the most powerful agent in the development of surgery,

medicine, obstetrics, and hygiene has been the introduction of the germ theory of putrefaction, which by experiment, elaboration, and widespread application has become an accepted truth.

As its first and most marked application was associated with the treatment of cases in surgical wards, it would be well to view its results in revolutionising such wards and in increasing the usefulness of general hospitals.

What was the condition of the ordinary surgical wards previous to 1870? The word "Hospitalism" was used to express an unwholesomeness which was considered normal to and always present where sick persons were aggregated, and implied that the atmosphere was injurious rather than favourable to health.

The wards contained a highly infectious atmosphere contaminated by, and in turn contaminating, the patients in it, producing an uncertainty in the healing of wounds, whether traumatic or operative, that dogged the footsteps of the surgeon. Inflammation and suppuration were expected as a matter of course; pain, fever, secondary hæmorrhage, tetanus, pyæmia, or hospital gangrene were never absent from the wards, and were ever causing the best efforts to end in failure or disaster.

From the spring of 1865 until the autumn of 1869 Lister was engaged in developing his antiseptic theory. During this time, by its application, wounds healed without inflammation, and its results and the effects produced in his surgical wards were in the highest degree satisfactory. The wards were converted from being some of the most unhealthy in the kingdom to models of healthiness.

His principles of treatment are now the basis of successful surgery everywhere, relieving patients of suffering and danger, reducing their stay under treatment to a fraction of the time formerly required, and consequently a much larger number of patients can be treated and the usefulness of the hospitals is materially increased.

It is correct to say that Listerism to-day means asepsis or a perfect isolation of the patient by guarding his wounds from all sources of infection, by means of carefully selected and applied dressings in a wholesome atmosphere. Wounds heal rapidly, there is neither inflammation, fever, nor suppuration, the atmosphere remains uncontaminated, and the phantoms which formerly shadowed the work of the surgeon retreat where Listerism advances.

The adoption of Listerism to maternity hospitals has reduced the mortality to the limits of normal parturition.

Formerly maternity hospitals were condemned by many on account of

their high puerperal death-rate, which, on the introduction of modern methods, fell from 9 per cent. to a fraction.

Previous to the introduction of antiseptic methods the high mortality was attributed to the influence of the hospital, the social state and morals of the women, and the admission of grave cases.

To-day, when the similarity of puerperal and surgical infection is generally admitted, such hospitals are found perfectly healthy and convalescence is uncomplicated. But let overcrowding occur, the morbid organism creeps in, multiplies, the points of attack increase, the resistance of the patients becomes lessened, and the former terrors return, with their associated fearful mortality.

The treatment of tuberculosis by isolation and pure air has converted an incurable into a curable and preventable disease. The sanatoria devoted to this object have been designed for the benefit of the patients especially.

Hermann Brehmer must be regarded as the pioneer of sanatorium treatment of tuberculosis. He held that it was an infectious disease, and argued that anything which protects one man from falling ill must be able, if properly employed, to cure another of the same disease, and from this argument he evolved the modern sanatorium treatment.

Recently the Advisory Committee, appointed by the King in connection with the erection of a sanatorium for tuberculosis in England, out of 180 competitors, selected three for the prizes sanctioned by His Majesty, each of whom showed designs in which separate rooms were provided for each patient.

The general hospital too, provided and supported by private contributions, has had for its sole object the benefit of the patients treated in it, and in this respect differs from the infectious fever hospital. The onus of supplying the latter has been placed by the legislature upon urban and rural authorities.

These authorities were urged to make timely provision for such cases of infectious disease occurring in their district as could not be isolated at their own abodes.

Thus the primary object of these hospitals was different from that of general hospitals. It was to receive patients who were a source of danger to the community in which they lived. The patient and his treatment were looked upon as a secondary matter to the protection of the community. This essential difference between the primary objects of the general and of the infectious hospital has had undoubtedly a marked influence upon their development. The general hospital has advanced with

the times to meet the demands of science. Its operating theatres have been rebuilt; laboratories for investigation have been added. Its surgical and medical wards have been remodelled and their whole atmosphere purified. Can we say the same of our infectious fever hospitals? I am afraid not. They have remained practically as they were both in structure and management, without the development of those precautions to protect the individual, which are such a marked feature of modern medical science.

The permanent establishment of infectious fever hospitals by sanitary authorities is a matter of comparatively recent date. On 14th July, 1866, on the appearance of epidemic cholera in London, an Order in Council was issued, directing that the provisions contained in the Contagious Diseases Prevention Act, 1855, should be put in force throughout England. On the 20th and 21st of that month two Orders were issued, one to the extra-metropolitan and the other to the metropolitan authorities, providing, where the medical officer of health or medical adviser recommended, that the board or vestry shall with as much despatch as practicable provide proper accommodation for the reception of such patients as have no home or cannot be properly treated at home, and may with advantage to themselves be removed.

Under sec. 26 of the Sanitary Act, 1866, power was given to any justice, on a certificate signed by a legally qualified practitioner, to direct the removal to a hospital within the district of any person suffering from any dangerous contagious or infectious disorder, being without proper lodging accommodation.

Previous to the Act of 1866 the legal enactments offered no such facilities to sanitary authorities or other public bodies as were calculated to lead to any general provision by them of hospitals for infectious diseases; the few existing pest-houses were erected by the private efforts of the parishioners, independent of any legal enactment.

In 1879 the Local Government Board sent a circular letter to all sanitary authorities, inquiring what accommodation had been provided for infectious diseases. It was found that in 296 out of 1,593 districts in England and Wales isolation of some sort or other had been provided.

The accommodation in many existed only in name, in others it was for only one disease. The provision made was mostly the outcome of panic, resulting from either the actual prevalence of some epidemic or the anticipated invasion of some infectious disease, and had its origin in munificent donations or bequests, supplemented by private subscriptions.

The slow progress made in providing hospitals for infectious diseases is well demonstrated in a paper read by Dr. Thorne at the Seventh Inter-

national Congress of Hygiene and Demography in London in 1891, when he stated: "I find that since that date, 1881, loans amounting in all to £448,769 have been granted to over 100 sanitary authorities for the provision of isolation hospitals."

The more efficient hospitals, which were provided by sanitary authorities in order to meet the wants of their districts, consisted of:

(1) An administrative block;

(2) At least four wards, in two separate pairs, in which patients of both sexes, suffering from two different infectious fevers, could be simultaneously treated;

(3) Certain out-buildings, such as washhouse, mortuary, &c.

Practically the hospital for infectious fevers is to-day the same, with the addition of receiving and observation rooms and discharge block.

The ward contains both acute cases and cases ready to go home to-morrow, and it is upon this fact that a serious question arises.

Each patient gives off infectious discharges with varying degrees of virulence, producing an infective atmosphere capable of exercising an injurious influence on all the patients with an intensity depending on the number and nature of the cases.

Such infection may be imparted to the atmosphere either directly by respiration or by discharges deposited on the bed-clothes, or elsewhere, to be afterwards dispersed in the process of bed-making or tidying, and it continues as long as the ward is occupied; that is, in many hospitals, continuously from one year's end to the other.

In scarlet fever, diphtheria, and measles, infectious discharges are given off from the respiratory passages, which, owing to their pathological state, might be compared to an open wound, and capable of receiving, incubating, and diffusing pathogenic organisms.

They are infected not only with the organisms peculiar to one disease, but may have a mixed infection of organisms varying with the different localities from which each patient has come.

Thus each patient adds his quota of specific infection in varying degrees of intensity, as well as the possible organisms of his mixed infection.

As certain streptococci favour the growth of a specific bacillus and increase its virulence, and the production of its toxines, such mixed infection is more dangerous for the patient, and as a consequence the general ward of a fever hospital exposes the mildest cases to the poison dangers possessed by the worst.

As might be expected, the patients suffer from such complications as discharges from the nose and ears and accessory sinuses, enlarged glands, albuminuria, and arthritis, resulting in prolonged stay in hospital, and probably in permanent injuries.

It is well known that persons with respiratory passages in a perfectly healthy condition can carry specific organisms, and thus spread infection, without showing any clinical evidence of their presence.

Is it not reasonable, therefore, to conclude that patients whose throats have been in an inflammatory or other pathological state are much more likely to harbour and spread the infection of the atmosphere of the fever ward they have just left?

In the interest of the patient himself he should be kept isolated from the other patients, and in the interest of the community to which he returns it is essential that he should be discharged from the purest atmosphere possible.

To this end, the following conditions in treatment and administration are proposed:—

(1) That the patient be admitted through a receiving room where he should be purified as much as possible by change of clothes, bathing and douching of nose, throat, and ears if practicable; such room to be thoroughly disinfected each time it has been used.

(2) That he should be removed from the receiving room to a specially prepared room, apart from other patients, where he should be treated until convalescent, and free from discharges or other complications; each patient being allotted a separate room.

(3) He should then be disinfected as much as possible by bathing, douching of the nose, throat, and ears, and change of clothes, and placed in a disinfected room by himself, if possible in a pavilion set apart for convalescent patients, for at least a week before discharge from hospital.

Such conditions would mean isolation of the patient, protecting him from danger by placing him in a pure atmosphere, hastening his convalescence, and from the first affording an opportunity to free his respiratory passages from infection.

These seem to me to be the lines upon which we ought to proceed, and that, too, without delay. I have elaborated no new idea, but simply urge that the methods and plans carried on in other hospitals should be adopted

in dealing with infectious fevers. We all accept the dictum that Listerism with its developments has revolutionised our general hospitals, and gained for them the confidence of the public, and, whether the shadow which flits over fever hospitals is to deepen or lighten, will depend entirely on the degree to which we put its principles into practice. In dealing with the so-called infectious diseases, we have difficulties to overcome which are greater, because more widespread, than those of other hospitals. It is easy to make a slip, but if errors are to be rectified and mistakes to be minimised, it can only be by persistently attending to details in the spirit of modern research. It is thus only, I believe, that fever hospitals can become a boon to the patients and afford the greatest advantage to the public.

Alderman Walton (Southampton) said he took it that Dr. Lauder, in his remarks, referred to fever hospitals in general, as he did not think from what he had said that the doctor referred to the Southampton hospital in particular. Their hospital was to some extent a very modern hospital, and was only opened four years ago. Of course they had an agitation for many years before it was built, and his friend Mr. Lemon, who was Mayor of Southampton at the time, took a great interest in the movement. They were met with various objections, principally that of expense, but they were all ultimately overcome, and the hospital was opened in 1900. Since that time it had been productive of the greatest amount of good for the town. Southampton was in an enviable position so far as the death-rate was concerned, for last week it was 9·7 per 1,000. That was a satisfactory state of affairs for a town liable to infectious diseases in the manner Southampton was. The infectious diseases hospital was controlled by the health department, and they had taken every precaution to keep the patients as much separated as possible, so that when they left the hospital they went from a pure atmosphere. Although the hospital was originally built to accommodate from 60 to 70 patients, they found in order to carry out the principles which they advocated they were compelled to increase their accommodation. They were now building another pavilion in which this principle of separate isolation would be carried out as far as it was possible for them to do it. When they had examined the place and the plans of the new portions of the building they would find that although Dr. Lauder had only put his ideas into writing that day the same ideas had been acted upon by the health department of the Southampton Corporation, and they were building their new Pavilion in such a way that it could be adapted to the most perfect form of isolation. Southampton was not like an inland town. There came to the port ships from all parts of the world every week, and they never knew what fever or disease such ships might bring to their shores, and as Southampton had been likened to the front door of England it was essential that they should be ready to deal with anything that might come their way. In addition to their land hospital they had eleven years ago founded

a floating hospital, and fitted it up at great expense to take in cases of small-pox or diseases of that character which might be brought to their shores. They had made ample provision at their land hospital also as they thought, but they were liable to an increased strain upon their resources at any time, and they were now enlarging it. Whether it was to the precautions or to the almost superhuman efforts of the Health Committee in Southampton he did not know, but there was the fact that there had been only two cases of scarlet fever notified since the 26th September last. That was a remarkable fact in a town of 110,000 inhabitants, and if their system of isolation contributed to the satisfactory state of things he thought they had every reason to congratulate themselves. He did not wish to suggest that the methods employed in their hospital were responsible for it, but the fact remained that the methods which they had adopted for the isolation of infectious diseases enabled them to discharge the patients out of a pure atmosphere after a short stay in the hospital.

Dr. Thomas Easton (Southampton) noted that in addition to the general hospital, Dr. Lauder had taken two special hospitals for his contrast, the lying-in hospital and the sanatorium for consumption. In the lying-in hospital it was well known that a septic case was at once removed, both for its own sake and for the sake of the others, and in the sanatoria consumptives were placed in separate rooms. Now, taking scarlet fever as the most difficult type, the question at once arose: Was scarlet fever a disease of such a similar septic type as to demand that individual isolation which was carried on in these other hospitals? Dr. Lauder answered this question in the affirmative, and he believed he was right, both from the point of view of the patient and the public service. Dr. Lauder had compared the respiratory passages in scarlet fever to an open wound. It was more, it was a wound of a peculiarly septic character. We could only apply a very modified antisepsis, and the only available plan left was to isolate and give access to that fresh air which was so inimical to pathogenic germs. In very many of our present-day hospitals we found acute, mild, and convalescent cases commingled. Now, this was not an ideal state, and it certainly was not a condition based on modern Listerism. They knew, for instance, that a bad case would contaminate a good case and delay its recovery. They knew that the more crowded a ward was the greater the complications and the longer the death-roll. They knew, which was most important from a public health point of view, that long retention in a contaminated ward would not prevent return cases, thus showing a patient could retain the germ in a latent form, and that it only required a transient catarrh to rejuvenate it, and thus disseminate the disease. If these were facts, and he thought they were admitted, then they pointed clearly to the conclusion Dr. Lauder had drawn, that scarlet fever would benefit as much from isolation and from fresh air as would sepsis or tuberculosis. They heard, too, of post-scarlatinal diphtheria occurring, and of scarlet fever breaking out in diphtheria wards. This seemed to him analogous to the breaking out of hospital gangrene in a surgical

ward. In such a ward a remedy would be at once applied; but when these accidents occurred in their fever wards they, as sanitary authorities, simply cried out in despair, "Non possumus." When a sanitary authority removed a patient they incurred a great responsibility, and they were bound to provide such accommodation as would not prove inimical to his early and complete recovery. It had been said that scarlet fever was not such a serious disease that they should take so much trouble about it. It was true the death-roll was not great, but the death-roll was not the only criterion by which it could be judged. Those of them who had been long in practice must have seen many cases in which more or less permanent injury resulted from scarlet fever. Personally, he regarded it as a disease requiring great attention. It might be said that the method advocated by Dr. Lauder was too expensive. They were not there to discuss expense, but he thought the method would not be so costly. He had procured two tables which would help to throw some light upon this. They were prepared to show the length of detention in the Southampton Isolation Hospital in contrast with that in the hospitals of the Metropolitan Asylums Board.

Number of cases admitted and average duration of stay in hospital for the years 1902–3–4:—

YEAR.	Scarlet fever.		Diphtheria.		Enteric fever.	
	Number of cases isolated.	Stay in hospital.	Number of cases isolated.	Stay in hospital.	Number of cases isolated.	Stay in hospital.
		(Days)		(Days)		(Days.)
1902	214	48	95	24	105	41
1903	359	36·5	157	21	99	35
1904 (9½ months)	92	25·3	110	18·9	19	22·1
Corrected figures. (Errors in diagnosis deducted.)	86	26	99	19·5	12	28·5

Extract from Prof. Smith's article in Journal of State Medicine, July, 1904:—

According to the Metropolitan Asylums Board's Tables the average duration of stay in hospital of cases in 1899 was:—

Scarlet fever .. .. 70·4 days,
Diphtheria .. .. 59·2 „

In 1903 the average duration of stay had diminished to:—

Scarlet fever .. .. 61·4 days,
Diphtheria .. .. 52·2 „

The length of retention in the Southampton Isolation Hospital would be seen to be very much less than that under the Metropolitan Asylums Board. If such

diminished retention was due to the different methods employed, and he thought it very probable, then any extra initial expense incurred in enlarging hospitals, so as to procure more perfect isolation, would be amply compensated for by the lessened expense of each patient. The question Dr. Lauder had discussed was both important and serious. He thought his contention was right that the fresher the air, and the more complete the isolation, the quicker would be the recovery of the patient, and less would be the chance of return cases, and therefore the greater gain to the community.

Dr. Groves (Carisbrooke) said he considered meetings of this kind particularly satisfactory, for they afforded members of the medical profession the opportunity of meeting those appointed to carry out the Acts of Parliament in connection with the work of public health. They were indebted to Dr. Lauder for the manner in which he had arranged his paper, as it placed the question under discussion clearly before them. They had been discussing for a long time the question whether isolation hospitals had realized the expectations formed of them when first they were established and since. They had been discussing, in fact, whether it was worth while to isolate scarlatina, and whether or no isolation hospitals had justified the enormous expense to which the country had been put in providing them. What did Dr. Lauder say? He urged them to perform their duty as sanitary authorities by doing all that was possible to deal in the most efficacious way with diseases that were inimical to the public good. When they have done their duty by taking the best possible care of people suffering from preventable diseases, it will be time enough to bring forward statistics of a more or less unreliable nature to prove that the isolation hospitals have not met the expectations which they had confidently formed of them. Oxygen and sunlight affected pernicious organisms in such a way that they could not live, and acting upon that knowledge Dr. Lauder advocated that fever patients should have abundance of fresh air. Then, isolation hospitals had done a great work in providing accommodation for poor people superior to that they could obtain in their own homes, and thus aiding in their complete and rapid recovery. If they took a patient from among the community for the benefit of the community, they ought to place those persons under the best possible conditions to hasten their recovery. They had no right for the sake of their own safety to take persons into their hospitals unless they did all that they possibly could for them. They had no right to talk about a penny or a two-penny rate. If they wanted to protect themselves thoroughly they would have to pay for it. He thought it was inconsistent that any body of ratepayers should object to pay adequately for what was to themselves a very valuable insurance against the risk of disease.

Dr. Willoughby (Eastbourne) read a letter which he had received from Dr. Newsholme in which he referred to Dr. Lauder's paper, and said it was not right in view of the evidence obtainable to take the isolation of each case of scarlet

fever from every other case of scarlet fever as a counsel of perfection. Dr. Newsholme instanced a case which was discharged from Southampton and had gone to Dr. Newsholme's district. The case had been isolated, but notwithstanding this it gave rise to a slight outbreak after arriving at Brighton. Dr. Willoughby added that he was not so pessimistic as some of his medical colleagues. He thoroughly agreed with Dr. Lauder's principles that they should do all that was possible to bring their fever hospitals right up to date, and meet the wants of each district in the most thorough-going manner. He thought the experience mentioned in regard to some hospitals was somewhat unfortunate, and if his hospital were such a failure, personally he should be inclined to take to some other business and go away from such a hospital as that described. He had seen a great many cases in hospitals which he had attended, and had very seldom seen any cases of injury such as had been described. It seemed to him that the experience mentioned could not apply to Southampton, for here Dr. Lauder had an excellent hospital. They were now building a hospital block at Eastbourne, and one of the places at which they gained valuable information as to the way in which to build a hospital was Southampton. They started with Southampton in the time of the late Medical Officer of Health, Dr. A. Wellesley Harris, and had also obtained ideas from other places. Hospitals for infectious fevers ought to be constructed with a regard to the interest of the patient as well as of the community. He thought in regard to new hospitals that it was really so. It was difficult to adduce evidence from figures, for the only way was to compare the figures in the case of patients who did go to the hospitals and the patients who did not. If they worked out the result as regards complications, the hospital patients sometimes apparently fare worse than those patients who stayed at their own homes, but the patients removed were frequently the very poor patients who were often *in extremis*, while those left outside were the rich, the mild, and the wrongly diagnosed cases, and being the well-to-do were well looked after. They could not compare the two in figures at all, but yet taking a record of ten years in Eastbourne the complication rate and the death-rate came out lower in the hospital cases. The outcry against hospitals was overdone, and the thing to do was to keep the hospitals up to date; with regard to the methods advocated by Dr. Lauder his ideas were expensive, not only as to the initial expense, but also as to the staff that would be necessitated for looking after each patient separately. They must not overcrowd the hospital, but the Local Government Board had given them a limit which was a fair one, and they ought to accept it. A comparison had been made with the King's Sanatorium, but he did not think they were on all fours. He had a strong view on that subject, and thought it a great mistake to spend so much money to accommodate one hundred patients when it was possible to so expend the money as to accommodate a thousand patients. But the time had not come when each patient should have a separate room. It was too expensive altogether, and was not necessary. It had also many disadvantages, and the loneliness would be very great.

Mr. Edwin T. Hall, F.R.I.B.A. (London), said it had been his privilege to erect many hospitals of all kinds, some of the largest hospitals in the kingdom, one covering 20 acres and another 40 acres, and he might speak with some authority with regard to them. In reading the paper he was struck by the pessimistic view which Dr. Lauder took with regard to isolation hospitals. By implication he suggested, in regard to fever hospitals, that they had not applied modern methods and energy to the structures. He was rather under the impression, until he read this paper, that it was the fever hospital that had set the model to the new general hospitals constructed; the basis of design on which nearly every old general hospital was constructed was largely that of a self-contained building, but the type set for fever hospitals was the pavilion, with plenty of open space around each, and that was the type followed for new general hospitals, whether they were in England, Germany, Belgium, or France. Dr. Lauder told them the general hospitals contained a highly infectious atmosphere, and that his proposal was the remedy for it. The highly infectious atmosphere in the old hospitals was owing in the main to the absolute absence of ventilation. It was only in comparatively modern times that ventilation was considered at all. Dr. Lauder said that Listerism to-day meant, among other things, the guarding of wounds from all sources of infection by means of carefully selected and applied dressings in a wholesome atmosphere. That was the whole crux of the question. It was the wholesome atmosphere that they must aim at when designing a hospital. Without it, he might almost say that it did not matter whether they put on the bandages or not. As an illustration of this, he might say that some time ago in one large fever hospital that he put up, the medical superintendent made an experiment. He closed the whole of the windows for a fortnight, and in the depth of winter he was able to keep the air warmed at a temperature of 60 degrees in absolute purity. The air was as pure inside as it was outside. What more could they get? The air was always circulated, and it did not remain in the room for the evil effects described to take place. If there was always a flow of air it followed that poisonous emanations were carried away, and there was no injury to the patient. They might put on a ship at sea a thousand people without having an injurious atmosphere, but they could not put the same number of people in the same cubic capacity in a slum in a back street, because they could not get a sufficient flow of air to enable them to live comfortably. In a ship they could get the necessary flow of air. Dr. Lauder next referred to the provision of separate rooms provided for each patient in the King's Sanatorium. There was nothing new in that. He had designed and erected a similar place, but the reason why he advocated single rooms in sanatoria, was not because of the impurity of the air, but because of the annoyance and trouble which the coughing of one patient caused to another, and also to provide greater comfort and luxury for the patient. The circumstances were peculiar to consumption, but the principle was not carried out throughout all sanatoria. In the following paragraph they found a statement which he hoped was not true. They were told, in fact, that the general

hospital was designed for the cure of patients, but that such was not the primary object of the fever hospitals. Surely it was the primary object, and he hoped it would never go forth that it was a secondary consideration. He did not imagine for a moment that it was so, and he was sure that any gentleman who had been over the infectious diseases hospital would see nothing in the hospital but consideration for the patients and for their recovery. Dr. Lauder, in his description of fever hospitals, said the ward contained both acute cases, and cases ready to go home to-morrow, and it was upon this fact that a serious question arose. It might be the case in small hospitals, but it was not permitted in big hospitals. Hospitals which he had constructed at Leeds, Plaistow, and other places, had one ward for acute cases and one for convalescents. He knew of no large modern fever hospital without such ward specialization, and without isolation pavilions. With reference to the statement that patients gave off poisonous discharges, that was no doubt true, but all that was an argument in favour of sterilized garments being used by the patients in bed; if anything did escape into the atmosphere it could not be an injury to a neighbouring patient, because the air was always flowing out. As to scarlet fever patients leaving the hospital there was little danger, because they always left in robust health. The general scheme suggested by Dr. Lauder was practised in every big hospital in the country, but when they came to this single bedroom scheme, was it going to do all that was claimed for it? In the first place they had to consider the enormous expense that would be entailed by the additional staff needed. In scarlet fever cases the larger proportion were children, and they could not leave a child in a room by itself. It would be miserable, and they must consider what the mental effect would be upon it. When it was placed in a ward with other children, and was enabled to play with toys, it was helped towards its recovery. Were these rooms to open on to a closed corridor? If so, according to this theory, the condition of the corridor was going to be very bad. He did not find any statistics showing that the treatment of patients in single bed wards produced better results than a ward containing 14 people. He did not think any municipal authorities would be justified in incurring the extra expense, which,he thought, would mean 30 to 40 per cent., or even 50 per cent. to construct a big hospital in the way suggested, or that in doing so they would obtain better results than in the up-to-date fever hospitals as now constructed. He hoped the result of this meeting would be to free fever hospitals from the suggestion that they were not sanitary, or in any way compared unfavourably with the general hospital.

Dr. Norman Aldridge (Southampton) said he agreed with what had been said by Dr. Lauder and Dr. Easton. He had followed with great interest the methods adopted by Dr. Lauder in the treatment of scarlet fever cases. In spite of some statements that had been made, especially by Mr. Hall, that these methods were carried out in all large fever hospitals, he must say that that was not his experience; neither was it, he ventured to say, that of many other

medical gentlemen who were present. During the past twelve or eighteen months Dr. Lauder had endeavoured to carry out the treatment of isolation of scarlet fever cases on the lines laid down in his pamphlet, but he had not so far been able to carry out the whole of his recommendations. Especially was this the case in regard to recommendation No. 2, but the other recommendations he had carried out. Those of them who had followed the results were persuaded that if they were not entirely due to the method adopted they had warranted a continuance of it, and if possible the advancing of it to a stage further, to the extent of giving each patient a separate room. They had certain figures for a period before the new method was adopted, and also for a period subsequent. In the first case 208 cases showed an average stay of 48 days. Subsequently, in 353 cases the average stay in hospital was reduced to 34 days, a reduction of 14 days in each case. The number of return cases was under the new method 2·15, and with the old method 4·27. On the question of expense he stood on the ground, not of a medical officer of health, but that of a representative of the ratepayers. He was returned to the Council by the ratepayers, who urged him not to run up the expenditure too much, and he was put on the Health Committee because his medical knowledge might be of use. He looked upon this matter from an economical point of view. It seemed to him that if they spent more money on the treatment, and largely reduced the length of stay of patients in hospital, they would effect some economy. In 1903, when Dr. Lauder put his method into operation, there was a saving of 4,942 days in the stay of patients in the hospital. That, put in money, must mean a large saving. He was surprised that Dr. Newsholme should suggest that Dr. Lauder's method had failed because he had one case which went to Brighton and caused a few cases.

Dr. Nunn (Bournemouth) said this discussion had interested him very considerably, for he might say that the provision of an up-to-date hospital in the County Borough of Bournemouth had contributed more to the good results which they had obtained than any other single thing in their sanitary armour. He had been a medical officer of health for over thirty years, they built their hospital in 1886, and it consisted of one pavilion and a small administrative block. If he knew anything of isolation hospitals he would impress one thing upon local authorities who had not yet built such a hospital, and it was that they should not on the plea of economy build an administrative block that would prove too small. They should look well ahead to the probable requirements twenty-five years hence, and it would be the best economy in the end. They had reached the ideal condition in Bournemouth of a zymotic rate of 0·63 per 1,000. Before they could achieve the best results they must educate their ratepayers up to the point where they appreciated the full benefit to be derived from a proper and enlightened attention to those matters. They had an educated public opinion in his district, and the good results obtained were in great measure to be attributed to that fact. He had dealt with a large number of cases, and he never discharged any case of diphtheria until it was quite free from any

specific bacillus. He had also treated cases such as were described, but he had never been able to obtain such results as those which had been mentioned. He had not yet reached the limit mentioned by Dr. Lauder, although he had been trying for years, and he could not yet do it and insure perfect safety.

Mr. Parr (Lymington) said he should like to point out the difficulties in connection with the provision of isolation hospitals in small urban and large rural districts. The cost of building was very heavy, and if by any means the cost could be given of the erection and maintenance of a building on the basis of maintenance by a combined district, it would be a valuable addition to the paper.

Dr. Meredith Richards (Croydon) said Dr. Lauder seemed to start with the assumption that a large amount of secondary infection took place in hospitals. His experience, excluding errors in diagnosis, did not agree with that assumption. It was practically easy to say whether a case, when it reached the hospital, was likely to be a mild or a serious one. Now if secondary infection of scarlet fever or diphtheria patients occurred in hospital with a more virulent variety of the scarlatinal or diphtheria organism, then one would find mild cases of scarlet fever or diphtheria to become malignant soon after reaching hospital. In his experience this did not take place. With regard to secondary infection with septic organisms the answer was not so easy, though he agreed with Dr. Newsholme that "septic cases" were in the vast majority of instances "septic," *ab initio*. He believed that return cases of scarlet fever were due to protracted infection, and not to the mechanical carriage of infection by the mucous membranes of discharged patients. If the latter occurred frequently one would expect that nurses and doctors would convey scarlet fever to their own families. Experience did not agree with this. As Mr. Hall had stated, the majority of large hospitals had carried out the main idea of Dr. Lauder's paper. He did not know of any large hospital in this country where the practice of separating the acute and convalescent cases was not carried out. That did not reduce the number of return cases, and he agreed with Dr. Newsholme that the return case is a part of the natural history of scarlet fever. With regard to one thing he was in absolute agreement, and that was in reference to the admission of fresh air in all the wards. Too many men in the past had been afraid to admit fresh air to scarlet fever wards. Some of them had now almost come to the point of treating scarlet fever in the open air, and he hoped Mr. Hall would help them further on the road in the future. He suggested that it was not fair to compare the figures for Southampton with those of London, and adverting to the point touched upon by Dr. Nunn, if only one bacteriological examination was made patients could be sent out under three weeks, but he did not think it could be done with satisfactory results. He thought also that many patients would object to be treated in separate rooms throughout their illness. Architects and hospital authorities should, however, provide much more accommodation for the isolation of doubtful cases, and of double infections.

Dr. McCallin (Southampton), in supporting Dr. Lauder's proposals, referred to the Pasteur Hospital, Paris, in which patients suffering from different infectious diseases were placed in separate adjoining rooms, and attended by the same nurse. Although it would, perhaps, be difficult to apply the methods suggested by Dr. Lauder to all isolation hospitals as they existed, yet a great deal could be done to improve the condition of affairs, and prevent the herding together of patients, for example, scarlet fever patients, mild, severe, and septic, from their admission till their discharge. The separate treatment of patients facilitated their early discharge, and consequently rendered the hospital more useful in dealing with extensive outbreaks.

Dr. Lauder said in reply, Mr. Hall had set himself the task of going through the paper and tearing it to pieces. It would take him half a day to answer Mr. Hall's criticism, nearly all of which was entirely irrelevant. He had discussed what fever hospitals were in early times, and whether their structure and arrangement had kept pace with modern science. Mr. Hall, from his own experience, seemed to think the present day fever hospital was perfect. Well, he held in his hand a description and plan of one built this year, and he should like to know where the difference lay between it and those he had described. It had not even an out-bathing station or a discharge block. Mr. Hall was somewhat mixed on the subject of asepsis, and attributed to architecture what should be credited to Listerism, and his suggestion as to using specially prepared antiseptic underclothing was one which would not commend itself to the medical profession at least. Mr. Hall said it was practically only ventilation of the hospital that was required. He did not say that ventilation was not very much to be desired; it was, but ventilation was only part of the remedy. What about the Royal Infirmary Hospital at Glasgow, where Lister developed his theories? Had it been pulled down? It was practically the same old building to-day, but Listerism had changed the results. If Mr. Hall wanted to go through his paper line by line, let him, at least, start with facts. When Mr. Hall told them that hospitals provided separate rooms for all cases in an acute condition he was quite incorrect. There was no hospital more up-to-date than one which they had in Southampton, and there it could not be done. He could assure them that at Southampton there were bacteriological examinations made in every case, and no patient was discharged till they were satisfied a cure had resulted. There was a great necessity for the improved isolation which he advocated, and no authority had the right to take children into its care unless it was prepared to take proper precautions in regard to them. He knew they were anxious to get to their luncheon, so he would not detain them further.

CONFERENCE ON RECENT EDUCATIONAL DEVELOPMENTS.

With Special reference to the New Education Code and the Report of the Mosely Commission.

(Arranged by The Royal Sanitary Institute and the King Alfred School Society.)

November 11th, 1904.

ADDRESS

By the Rev. H. B. GRAY, D.D.,
Warden of Bradfield College.

I CONFESS to feeling a little out of place in the position of Chairman this afternoon, for, as responsible for one of the great boarding schools of England—those semi-monastic institutions which loom so large in the public eye, and do so much or, as some think, so little, in making or marring the future manhood of England,—I am by no means sure that I am a satisfactory representative of the ideals of The Sanitary Institute or of that most interesting and experimental School Society which has joined hands with the Institute in organising the meeting here to-day.

But I flatter myself you have asked me to preside on this occasion because I may have shown in my short and rough account of my experiences on the Mosely Commission that I am not one of those who think that we in England are living in the best of all educational worlds.

I am free to confess that not only have we much to learn, but also much to unlearn, to judge from what my twenty-five colleagues and myself on the Commission saw and heard on the great Continent of America.

Let me confess one thing more, that I am by no means persuaded that the boarding-school system as carried on in England in our great historic schools is *in every respect* the best that can be devised for the betterment of the physical, mental, and moral well-being of the English race.

It must be remembered that the great conceptions of William of Wykeham and his imitators were the conceptions of the 14th and 15th centuries, when learning was concentrated in close religious corporations, and not disseminated through the length and breadth of the land. Therefore it seems *a priori* extraordinary that, while other departments of life have suffered organic alteration, the principles and practices of the educational world alone of the institutions of England, in our upper and middle classes at any rate, have been preserved substantially unchanged for five centuries.

Practically the same limitation of studies, the same mode of viewing social life, with small concessions to the most imperative of modern requirements, are pursued in the cloisters and halls of our historic public schools, as were dominant in the Tudor period.

The same *vis inertiæ* appears in even greater force at our ancient universities, and we rub our eyes to find that the same entrance bars—the quantulum of Euripides, of Horace, and of elementary mathematics,—bar admission to Oxford and Cambridge as in the days of the Stuarts. Reflect for a moment that no scientist, however brilliant, can pass these adamantine gates if he has not a nodding acquaintance, at least, with two ancient languages, and to force his entrance he has sometimes to degrade himself and these dead tongues by the vilest expedients.

I mention these facts as illustrations of the astounding conservatism which in England modifies and, as some of us think, impedes the progress of educational ideals in England.

Let me make my own confession of faith. Though a boarding-school headmaster for 25 years, and though I was brought up in the strictest sect of the Pharisees—that is in the school of William of Wykeham,—and was an assistant-master for four years at the ancient foundation of Westminster, I still hesitate to express my confidence that the boarding-school system as at present carried on in most of our public schools is the ideal system of educational training.

At the most critical period of the child's mental and moral history, when the character is being formed with startling rapidity for good or evil, when passion and emotion are often strong, and reason always weak, a young boy is taken away from the refining influence of home, and of mother and sister, and plunged, with 300 or 400 other immature minds, into artificial congeries of monastic tendency, where tradition reigns supreme, where individuality is more or less lost, where the whole life is lived so closely together in field and class-room and dormitory, that the fledgling becomes a mere creature of his environment, and he emerges the mere embodiment (to use a cant term), of the school "tone." Much has

been said, and said with sincerity if not with exactness, of the character-forming power of English schools, but I should bid defiance to truth if I did not admit that there is much loss and much risk in this process of mutual attrition which is the characteristic of English so-called public school life.

Reflect how large a proportion of those who attend our most fashionable institutions are sent there not with much hope that good mental gymnastic may be gained, certainly not that they may meet with the ideally best conditions of sanitary food and life, not even because the parent is persuaded that the institution or homes are guided and guarded by the best men, but mainly, or to some extent, in order to form fashionable friendships and acquire a social *cachet*.

My honest belief is that, given the possibility of an ideal home, or rather, to be more accurate, given the possibility of every home being ideal (for the deficiencies of one household react on every other), given good discipline, and punctuality of hours, with a parent at leisure to help in looking after the child, constant interchange of views between teacher and parent, with plenty of wholesome exercise, not necessarily continual athletic competition (in which there is too much absorption at the present day), the day-school would be—I do not say is—the ideal system of education.

I am not here to-day (I hope you will not think it) to set before you the deficiency of the boarding-school system. Were it not at the present time, and had it not been in the past, productive of a good type of Englishmen, it would have been swept away like all other shams by the overwhelming tide of public sentiment. I am not here to foul the nest which I have had a share in building, but I am fain to confess that there are many changes, more or less organic in themselves, which I should, if I were a despot, or had to reconstitute English education, be forward to bring about.

It would seem, for instance, to the ordinary observer that the hotel-keeping principle of boarding houses, on which most, I may say all, of our historic foundations are organised, is theoretically indefensible. I mean that we should put into the hands of gentlemen whose primary duty is to develop the mental and moral characters of their flock, and for which alone they ought to be paid—and far more richly paid than they are—outside this legitimate emolument any temptation towards material advantage derived from the profits of food and lodging, though to their credit (be it said) it is a temptation which they often resist.

In the school over which I preside, and which can only boast of a little more than fifty years of existence, I have resolved that as long as I have

control of its destinies as chairman of its governing body, as well as its headmaster, no such hotel-keeping principle shall be suffered to exist.

In every boarding house of ours the housemaster obtains a fixed honorarium as a teacher, and he is paid a capitation fee for the responsibility over the moral and physical well-being of those in his house, but he takes no profits. Every cheque is paid into the coffers of the governing body, and every cheque for every article of food or household purchased is paid for out of the same chest.

Thus there is no temptation possible to any of the several housemasters to make money out of the eating and drinking and lodging of those entrusted to their charge.

Then again, speaking as a lifelong athlete, I should effect a forcible revolution in the encroaching demands which in season and out of season athletic competitions of a semi-professional and gladiatorial character make on the time and thoughts, not only of those who *attend*, but also on many of those who *mould* the great scholastic seminaries scattered up and down England.

I verily hope and believe that the tide has turned, and there is a reaction against this glorification of men's legs, which reminds us only too forcibly of the "panes et circenses" of imperial Rome.

But I am not alone in thinking that this absorption in the petty details of sport, originally no doubt inculcated as a safeguard against the evils of loafing, has had a seriously narrowing influence on the characters of grown-up English men and women.

Perhaps I may be allowed to quote words which I once wrote on this subject in the columns of the "Navy League Journal," and which I have seen this month quoted by Dr. Miller Maguire in his incisive article in "Broad Views."

What I am more immediately concerned about in the matter is that the cult of athletics has lowered and limited the ideals which might otherwise animate the minds of the young. Patriotism has become for them, quite unconsciously, limited to the four walls of the Public Schools of which they are for a few brief years members. Except in times of public stir and national peril, such as that through which we passed in the closing months of 1899, boys are bored rather than moved by appeals to patriotism in a wider sense. Such, at least, has been the experience of many schoolmasters.

And a sentiment which is not stirred during the impressionable time of youth, when the character is plastic and all generous impulses are easily moved, is not likely to form a lodgment in the more prosaic days of man-

hood, when the mind is fully formed, the principles fixed, and the routine of the business of life has taken the edge off unselfish ideals.

Many more points I might urge, if time and your patience allowed, to prove that in some respects the public school education of England requires readjustment, if not organic change, at any rate so far as the upper classes are concerned. It is and was very interesting to me as a member of the Mosely Commission to compare the American public school, properly so named, with its misnamed English namesake; for across the Atlantic, schools are public as you know in the best sense of the word, that is, they are open to all, irrespective of creed and class, while with us, if there be any real definition possible of the epithet, they are public only in the sense (and as I have said to a very limited degree) that not the individual but a corporation secures the profits of the institution which it governs.

With most interesting addresses awaiting us, I forbear to dwell on more than one point of contrast, but I willingly accede to the appeal which has been made to me to express my views briefly on the subject of co-education, which forms one of the characteristic features of American education.

As I said in my remarks in my Mosely Commission reports I approached the study of that system with an absolutely unbiassed mind. I examined minutely into its working in New York, Philadelphia, Washington, Boston, Buffalo, Ann Arbor, Chicago, and again in some of the large towns of Canada, and was unable to trace any foundation whatever for the criticisms which might be made, and of course have been made, on *a priori* hypotheses by those who, without practical experience of its working, have condemned it, or at least opposed it on moral considerations. On the contrary, I unhesitatingly express my conviction that even when the system of co-education is carried on up to the age of 18 and 19, not only in day schools, but where there is a boarding element, and where the young people are separated only by different blocks of dormitories, even in all these (what we should regard as) extreme conditions, the moral and social effect is gratifying in the extreme.

There is, as I ventured to say in my report, a noticeable and absolute absence, or rather disappearance of sexual strain. The boys are humanized and rendered better social animals than is observable in many English homes—they are easy and free, instead of being free and easy (an alternative collocation of epithets which I think you will understand); the hobbledehoyism common to English boyhood seems to be non-existent—not to speak of the entire absence in American and Canadian schools of those darker forms of moral evil, which have from time to time haunted some of our semi-monastic institutions.

I observed more "sensibility" on both sides, *i.e.*, with both sexes—more mutual appreciation, if you will, and I can also declare emphatically (what I was not prepared to expect), there was an absence of sentimentalism. In my capacity of inspector of those schools in the United States where co-education had been established as a system I used often to take up the lesson from the teacher, sometimes a lesson in English literature, Burke, or Racine, or Virgil, and I never in my somewhat lengthy investigation saw any sign of what I may call levity of conduct occasioned by the mixture of the sexes. There was much camaraderie, and no awkwardness, and I make bold to say that, in my judgment, if the system of co-education were carried on in our own country, not only in day schools, but also in ordinary boarding schools, I believe that none but good results would result to the mental and moral development of young English men and women.

On one other point I will but shortly dwell before yielding my place to the first speaker on our programme to-day.

I observe that The King Alfred School Society lays special stress on co-operation between teachers and parents. This also, in many respects, was a satisfactory feature of American education. There, as in this interesting society, frequent evening meetings or conversaziones were arranged where the character and progress of the pupil could be thoroughly sifted and discussed.

In our English boarding schools this co-operation unfortunately either exists imperfectly through the medium of written reports or disappears altogether, and there arises instead thereof in some schools a feeling amounting even to mutual distrust, so that it has become almost a fashion with schoolmasters to quote with approbation the cynical dictum of a great headmaster: "I have found boys always reasonable, assistant-masters sometimes, but parents never."

All this is very bad. First of all, the parent only becomes unreasonable because he or she is given no opportunity of consultation, and everybody knows that the scanty food of information doled out by the two or three words of a written report mean little or nothing to the anxious parental mind. A smart young master of mine some years ago, commenting on the want of progress in a pupil, and mightily pleased with himself, wrote in his report: "I can teach this boy nothing." On which the parent wrote enclosing the criticism, and saying: "Of course, after this confession of weakness, the assistant-master in question will not expect you to keep him on your staff any longer."

Personally (if I may interpose a personal note) I have instituted at my college, besides written reports, a system of Open Days which take place

every month, when parents are expected and invited to come down and to discuss the progress and prospects of their boys with the headmaster and his colleagues.

Allow me, therefore, in conclusion, to congratulate The King Alfred School Society on the most excellent and reproductive provision which they have made in their scheme for this important collaboration of parent and teacher in the development of the children, for whose mental and moral well-being they are jointly and severally responsible.

On many other points I long to touch, but want of time and want of patience, I fear, alike forbid. May I, therefore, thank you for the most kind and attentive hearing which you have accorded me, and allow me to become now a listener instead of a lecturer, for in a meeting like this I know there is much to hear and to profit by; for, said Chaucer of old,

"Gladly would I learn, and gladly teach."

The former rôle suits my position and nature even better than the latter.

ALFRED GREENWOOD, M.D., D.P.H.,

Medical Officer of Health, Blackburn.

(Member.)

THE Sanitary Institute have honoured me by asking me to open a discussion on the above subject, which cannot be over-estimated in its importance to all classes, inasmuch as the prosperity of a nation, individually and collectively, is associated with the efficiency of its general education.

Recent educational developments include the passing of the Education Act of 1902, and the administrative measures which have followed upon it, together with a general awakening of an interest in educational questions which preceded and accompanied this event.

Special reference will be made to the light which has been thrown upon educational questions by the recent report of the Mosely Commission to America, and to the recent modifications which have been introduced in the Whitehall code.

The educational position which these developments have created in

our country is therefore at the present moment not only important, but interesting.

New authorities have been created for the purpose of dealing with education, and have been invested with powers far wider and greater than those of the School Boards which they have replaced.

Further, the recent action of the Board of Education confirms the impression given by a perusal of the Act of 1902, that it is the intention at head-quarters to allow the new local bodies to a great extent to work out their own salvation rather than be controlled by the offices in Whitehall; in fact, to substitute local autonomy for official uniformity.

The result is, in the first place, to bring local authorities face to face with a number of new problems; and, in the second place, to call upon them to solve those problems, to a large extent for themselves, with the aid of such assistance as they can obtain from the experience of other countries, and from the advice of experts.

The Mosely Educational Commission.

The Mosely Commission is a carefully considered design for obtaining the result of the experience of the United States in educational matters, and its results will be of the highest value to new educational committees.

The sincerest thanks of the community are due to Mr. Mosely for originating this Educational Commission, and the report of each commissioner deserves the most careful consideration.

In passing, it should also be mentioned that the admirable series of reports issued by the department of the Board of Education, devoted to inquiries and reports, contain an immense mass of information regarding educational work in many countries, including the United States.

Mr. Mosely initiated his educational commission to the United States of America, from October to December, 1903, and a meeting of prominent educationalists was convened in London, and presided over by Lord Reay, in order to advise him about the subjects for inquiry and the selection of delegates. The Board of Education also showed great interest in the commission. As stated in the opening page of Mr. Mosely's remarks "the new Education Act opens the field for some really useful work to be achieved by a commission such as this containing representatives of all branches of education. The Act has been worked on lines similar to those followed in the United States. In that country each State makes its own rules and regulations with regard to education, and has the right of levying taxes to cover the expenses incurred. The new Act gives similar power, within certain specified limits, to the county councils, and it now remains for those bodies and the public at large to decide what shape public

education shall take in the future, what money shall be spent, and how it shall be administered."

The Commission very wisely decided to make no reference in their reports to any controversial matters such as political and religious differences.

Mr. Mosely has given his own impressions as a business man, and these are followed by the separate reports of the 26 expert educationalists.

The subjects placed for investigation before the Mosely Education Commission were :—

1. The development of individuality in the primary schools.
2. The social and intellectual effects of the wide distribution of secondary education.
3. The effects of specific instruction given—
   (*a*) In business methods :
   (*b*) In applied science.
4. The present state of opinion as to the value of professional and technical instruction of university rank, designed with special reference to the tasks of business life.

In his remarks Mr. Mosely draws attention to the large sums of money which are devoted to educational purposes in the United States, both in the way of buildings and equipment, to the enthusiasm of teachers and scholars, and to the special prominence given to the teaching of practical subjects in American schools.

He also expresses the opinion that our present method of popular education will have to be changed.

It may be inferred from Mr. Mosely's further statements that he believes the question of sports enters too largely into the everyday life of the English schoolboy. I cannot agree with this view. Indeed, it is open to question, whether in our elementary schools the subject of games is receiving sufficient attention.

Any deficiency in the systematic organisation of games at our public elementary schools must result in detriment to physical development, and in a lack of corporate school life.

Undoubtedly, the problem is a difficult one.

Playground accommodation is often very limited, and it is practically impossible to promote in connection with many public elementary schools those games which are a matter of course at schools frequented by the children of well-to-do persons.

Games, especially when organised as far as possible by the scholars themselves, are productive of benefits not only physical but moral.

On the physical benefits I need not enlarge, but will only point out

that they are far more important for children who live in narrow streets and small crowded rooms, than for those whose surroundings are more fortunate.

The moral benefits are the development of self-reliance, comradeship, and *esprit de corps*.

These qualities are certainly not less valuable to the working classes than to others, and the experience gained by the schoolboy in managing and working with his school-fellows would prove of the greatest value to the man.

Fuller information might have been given with advantage in the Mosely Report as to the physical condition of American school children. One of the Commissioners, Mr. Rathbone, found a great lack of playground accommodation in America.

One has often been struck with the fact that there has been too much "cramming" in our present educational methods, and too little inducement to make the scholar think and reason for himself.

In this connection it may be said that American schools are practically free from examinations. At the same time, however, there is State or University control, which exists in the form of inspection rather than of examination.

As a substitute for examination and prizes, there is in America the "accredited system," which involves the formation of a list of high schools known as "accredited schools," from which school pupils who present certificates of having satisfactorily passed the full four years' high-school course can be received into a university without examination. The schools are visited by one of the university professors of education, and if satisfactory are placed on this list; if not, the defects are indicated, and when remedied these schools are added to the list. Any school may be withdrawn from the list, or any student from the university, if found unsatisfactory. This method involves a more prominent attention to the opinion of the head teacher than to the opinion of an external examiner in the case of individual scholars. It also involves a daily guidance and record of the progress of individual scholars, and has the advantage of being continuous for a long period, as contrasted with the system of isolated examinations.

It is interesting to note the difference between the English and the American methods of awarding scholarships. We award university scholarships by competition in a single examination, where very often the successful competitor is the one best crammed for the special examination. In America, scholarships are awarded without examination to those whose circumstances render them in need of such help, and for the most part

after consideration of the whole previous educational career of the candidate.

The salaries of teachers in America appear to be too small to attract many men, and women teachers largely preponderate.

Dr. Armstrong believes that the methods adopted in training American teachers are no less academic than ours.

Mr. Heape recommends the inclusion of hand work in the training of teachers.

There is no pupil-teacher system in America, and frequent conferences are held.

Popular lectures (illustrated) are given to teachers weekly.

Public lectures are also provided by the New York Board of Education for parents.

The fact that elementary and secondary teachers undergo practically the same training is a feature of American education.

Evening schools appear to be more general in England than in America. Many of the English evening schools, however, are not true continuation schools, but, to a large extent, schools in which the work of the elementary school is done over again, because it has been forgotten in consequence of the early age at which children leave.

The enterprising, optimistic, untraditional character of the American nation, the custom of bringing all classes of scholars together at school, and the greater general belief in education, are some of the causes which produce a difference in the methods of education in America and England.

At the same time, Professor Armstrong is of opinion that, although we can learn much in organisation and administration from the Americans, as regards method we have very little to learn; and says, "indeed, in depth of purpose and originality our best work may not unfairly be said to be considerably in advance of theirs."

Also another of the Commissioners, Mr. Groser, says that "in elementary and secondary schools of England our need is a change, not so much in methods or curricula, as in spirit; and that on our present lines there is room for great improvement in the development of an attitude of inquiry and of individuality."

The Rev. Dr. Gray noticed that in American schools "there was none of the uncompromising, unquestioning discipline which marks the well-governed English school, and which, carried to an extreme, has a tendency to efface individuality."

Another commissioner, Mr. Black, noticed "good successful work on the part of the teachers in training intelligence, in teaching thinking, and in bringing out self-expression. The pupils were taught to give their own

views, and encouraged to make inquiry, and never snubbed because they made a mistake or said something foolish."

Again, Mr. Jephson considered "that the spirit of enthusiasm for education common to all classes in America is the really formative cause of the immense strides which have been made in so many different directions in educational matters," and Mr. Papillon thinks "the lesson, for us, of the American high school system lies in the greater variety of its curriculum to suit the practical needs of life."

Co-education as a factor in the mental and moral hygiene of school life was noted by the majority of the commissioners.

References have been made in the Mosely Report to the Dewey Experimental School, which forms the practice school of the training department of the University of Chicago. Professor Dewey believes that the children of his school are inferior in technical skill, but intellectually superior compared with those from the ordinary elementary schools.

There is a great preponderance of opinion in America in favour of making manual training universal in the elementary and secondary schools.

The necessity for variety of work, and the development of originality in manual training is evident to all.

The following are some of the important matters in which America appears to be ahead of England:—

1. The employment of university men in engineering, manufacturing, and business firms. The Americans, as a rule, do not think that a university training spoils a man for business. Moreover, many American professors are actually engaged in the practice of the business of scientific work they profess.

2. The superior training of American apprentices, and of those engaged in commercial education.

3. The difference in the public attitude towards education in America and in England, and its democratic character. A very great interest and belief in education prevails amongst all classes in America.

4. The fuller provision for secondary education, its cheapness (practically free to all), and its closer relationship to primary education.

5. An interesting little point in American schools is the cultivation of patriotism by the daily "salute of the flag."

It is worthy of consideration whether or not a similar Educational Commission to the one originated by Mr. Mosely would prove of value in England. This would elicit such points as the relation of teachers to parents, the attempts of teachers to accentuate the individuality of the scholar, and the success of teachers in stimulating a desire for future information in scholars who are leaving school, etc.

RECENT CHANGES IN OUR EDUCATIONAL CODE.

By recent improvements in our Education Code the foundation has been laid which will enable a scholar to pass by means of an educational ladder continuously from an infants' department to the university, because elementary and higher education are now under the control of a single authority, whereas the duties of the old school boards were restricted to the former.

Moreover, any mental and physical evils which might have arisen in the past from incompetent teachers and insanitary surroundings respectively, will probably disappear.

By the Education Act of 1902 the responsibility for the maintenance of all public elementary schools has been placed on local education authorities. The duty of keeping in repair and improving voluntary schools, however, rests on the managers. As these managers, however, have been relieved from the charge of maintenance, more in the way of improvements in sanitary and other conditions of buildings can be reasonably expected.

The Elementary School Code of 1904 has been re-arranged, and it has been simplified so that it may be understood by the general public. New regulations have also been made for secondary schools, evening schools, technical institutions, schools of art, art classes, the training of pupil teachers, and for students in training colleges.

A characteristic feature of the recent regulations issued by the Board of Education is the explanatory memorandum prefixed to each, in which the principles guiding the Board in their action have been fully and lucidly stated. (This is an innovation probably due to the able Permanent Secretary to the Board, Mr. R. L. Morant.)

New regulations for schools for defective and epileptic children came into operation in September, 1904, and a revised edition of the Building Rules has been recently issued.

The Board of Education are also sending out a companion volume to the Code containing suggestions for those concerned with the educational as distinct from the administrative aspects of school life.

Again, the Board have made the study of hygiene an essential part of the syllabuses in the theory of education both for students in training colleges, and for candidates for the certificate examination. This has been done with a view to rendering the teachers more able to impart to the scholars the essentials of elementary hygiene. One is anxious to avoid the imposition of any unnecessary burden upon the present full curriculum of subjects taught in schools, but if greater attention could be paid to this

subject, the future mothers and fathers of our race would be assuredly benefited.

In order to secure this end it is desirable that all teachers should have a sufficient knowledge of this branch to be able to pass an examination in School Hygiene.

Amongst the recommendations made by the Inter-departmental Committee on Physical Deterioration appointed in September, 1903, are several relating to school children, viz., Medical Inspection of School Children, Feeding of School Children, Instruction in Cookery, Hygiene, Domestic Economy, and Special Schools.

The giving of special grants by the Board of Education for instruction in cookery, laundry work, dairy work, cottage gardening, manual instruction, and household management, are examples of attempts to instil sound practical knowledge into the minds of school children.

In recent years the superficial accommodation required in school-rooms has been increased in the Building Rules by one square foot per head, *i.e.*, to nine square feet, and ten square feet of floor space for the children in infants' and senior departments respectively. The Board of Education have not yet reassessed many of the old buildings. This is an improvement which should be effected soon, as the numbers eight square feet and 80 cubic feet still appear in the Code of 1904. Certain American States prescribe 15 square feet and 200 cubic feet per head respectively. It may also be noted that for higher elementary schools the Building Rules require a minimum of 13 or 16 square feet of floor space per child, according as the rooms are fitted with dual or single desks.

I am of opinion that the present standards of the Board of Education for size of outlet and inlet ventilation openings, viz., 2 square inches, and $2\frac{1}{2}$ square inches per head respectively, should be increased; *i.e.*, at least quadrupled, namely to 8 square inches of outlet, and 10 square inches of inlet. It is also worthy of notice that sites must be large enough to provide a quarter of an acre for every 250 children, and that there must be a minimum open space of 30 square feet per child in the playground.

Since March, 1903, the Board of Education have discontinued the special epidemic grant (Article 101), which was an inducement to teachers to report infectious diseases to the Medical Officer of Health.

It is difficult to say at present what difference this will make. In this connection I would say that I am strongly in favour of the prohibition of attendance at school of children under the age of five years. This would certainly lessen the spread of measles, which is such a frequent cause of school closure, and I do not think that the loss of education at school below this age would be serious.

The Board, however, are spending the money previously given for epidemic grants on improvements in the instruction given to pupil teachers. I believe that even greater sums than were promised are being spent on this instruction.

Great pains are now taken in the training of pupil teachers, and in maintaining a standard of efficiency. As stated in the Code, "the future usefulness of the teacher depends, not only on what he knows and can do, but on what he is, on his tastes, on his aims in life, on his general mental cultivation, and on the spirit in which he does his work."

Under the new regulations for the instruction and training of pupil teachers the age of engagement has been raised to 16, the time during which the pupil teacher is allowed to be engaged in actual teaching has been limited to half the time the school is open, and need not exceed about one-fourth such time, and the time for receiving instruction has been increased to a corresponding extent. A preparatory period of education of either one or two years before 16 is permitted; and when possible such period should, it is recommended, be spent in an ordinary secondary school. All this tends to the greater efficiency of pupil teachers, and ultimately, of course, of teachers generally.

It is also stated that "regulations of the Code with regard to the nature and scope of the instruction which should be given in all schools, have in view the co-ordination of the whole of the school work, giving freedom of initiative to individual managers and teachers, and providing for adaptation of the instruction to local requirements."

And if it is necessary in the interests of the scholars, the teacher is at liberty to deviate from any scheme, either in the way of omission or enlargement or curtailment of its various parts. The teacher is also advised to record the individual conduct, application, and advance of the scholars.

Thus greater freedom has been given in classifying scholars, and in drawing up schemes of instruction. Teachers and scholars work without the ever-present dread of an impending examination. The schools are visited for inspection and guidance, and examination is restricted to the comparatively few cases in which some partial or general weakness makes itself apparent in the course of an inspection.

The Inter-departmental Committee on Physical training have drawn up a new syllabus of physical exercises, which the Board of Education intend shall gradually take the place of the model course issued in 1902.

Useful work has been recently accomplished by local education authorities in the teaching of swimming to school children, and in municipally encouraging them to cultivate plants in flower-pots at their own homes.

Many steps are already being taken in England to bring the public library into closer relation with educational organisation, such as circulating school libraries, and distribution of these books by teachers, school classes at libraries and museums, co-operation between librarians and school teachers, etc.

Popular lectures, illustrated, are constantly being given all over the country, thus increasing the interest of the public in educational matters generally.

Further developments on lines already mentioned are desirable, and also in respect to such measures as reduction in size of classes, improvement of sanitary defects, provision of competent teachers, practical work in schools, &c.

There are two directions in which we may hopefully expect an *improvement in the interest and belief* in education in this country, which after all seems to be an indispensable preliminary to any great advance in educational methods.

Firstly: the creation of so many new educational authorities, and the discussion and criticism which are inseparable from the movement, cannot fail to stimulate the public mind.

Every member of an education committee is a possible focus of educational interest, and the many reports which have been recently drawn up by experts of the first ability on the educational needs of this or that locality must in their turn provoke fresh criticism and discussion. Thus the Education Act itself, in creating the new conditions, has to a certain extent ensured that the attitude of public opinion, which is necessary to enable them to do their work efficiently, shall be automatically stimulated.

Secondly: the past quarter of a century has witnessed a remarkable development of university-education in England. Not only has the movement known as University Extension been brought forward, but local universities have been established in several large centres of population.

These local universities have a far wider function than that of supplying education of the university type to a limited number of students.

The collection together in the midst of an industrial or commercial community, of a number of men of the type of those who staff our modern universities, and whose outlook on life is entirely different from that of the average merchant or manufacturer, cannot fail to have a most beneficial effect upon the tone of public opinion.

These features of the present educational position will be a powerful stimulus towards a more enlightened interest, and a wider and firmer belief in the best and highest education.

J. OSBORNE SMITH, F.R.I.B.A.

(Fellow).

THE rules prepared by the Board of Education for the guidance of educational authorities, school managers, and architects, more or less determine the accommodation and arrangements of elementary and secondary schools. The latest rules for *elementary schools* recommend seven classrooms for 360 boys or girls grouped round a central hall; single or two-story buildings; central halls with a floor space of not exceeding *four* square feet per child, and classrooms with a minimum floor space of *ten* square feet per child. Official sanction is thus given to overcrowded class-rooms to hold 40, 50, or 60, and to cheerless rooms which may never be visited by direct sunlight when occupied. It is interesting to note how little aspect has been considered in modern elementary schools. A classroom facing north cannot, however, be so cheerful and satisfactory either for teacher or scholar as one with a sunny aspect. Under the head of Ventilation there is a note, "Sunshine is of particular importance in its effects on ventilation and also on the health of children," yet numerous sunless classrooms can be found in recent schools.

The rules as to walls, floors, and roofs are excellent. Twelve feet is found by experience to be a reasonable height for classrooms, if adequate means for ventilation are provided, and the top of the windows are at the level of the ceiling. Thirteen feet may be regarded as a maximum height. The arrangements for cloaks ought to be more liberal than the rules suggest to allow the clothing to be quite separate: 6 inches space for each scholar is inadequate, especially in cold, wet weather. The lighting rules are good so far as they go, but it is surely desirable that every part of every window should be made to open, not a portion only, as suggested in Rule 11.

The hints upon ventilation and warming (Rules 12 and 13) are reasonable with one exception. Inlets for air, apart from doors and windows, should be arranged to permit the incoming air to be *warmed* in cold weather. If cold air is admitted through the inlets placed as suggested in Rule 12, keen currents of cold air a few feet above the floor are inevitable when the fires are lighted. "Corners of rooms furthest from doors and fireplaces" are suitable positions for *outlets*. It is significant that ventilation by mechanical means is not mentioned in these Rules, although it is in general use in some districts here, and in a modified form in America.

Notwithstanding the recent improvements in sanitary fittings, the Board of Education recommends that closets in elementary schools "should

be at a short distance, and completely disconnected from the school." In most cases this is unnecessary and undesirable from the point of view of health and supervision. The Board admits this by permitting closets within the buildings for girls in secondary schools.

The table giving the number of w.c.'s and lavatory basins required for schools of various sizes is open to criticism on the score of extravagance. 3 per cent. for w.c.'s and 5 per cent. for basins is found in practice to afford ample provision for girls' schools of 150 to 300. It is hoped when these Rules are again revised these points will be reconsidered, that the trough closet will disappear, and that 3-inch or 3½-inch soil pipes be recommended instead of 4-inch.

In Rule 15 (Water Supply) it should be suggested that taps labelled "drinking water" should be connected direct to the main supply pipe, and that the use of filters should be discouraged.

Eighteen inches of desk and seat for each scholar is regarded as sufficient (*i.e.*, 4½ feet only of floor space out of the 10 feet). Single desks, which are universally used in America, are discouraged here for elementary schools. If used it is suggested they should be arranged in pairs with only 2 inches of space between them! Reasonable isolation of each scholar, so desirable from a hygienic standpoint, is thus given up to economy.

Although it may be occasionally necessary to group pupils as near as possible to each other, it is to be regretted that official encouragement should be given to placing them close together during all the hours of class-work. Eighteen inches is too small an allowance for each scholar at a desk, either for comfort or for health. Single desks are invariably used in America; but the Code declares: "Single desks are not necessary in an ordinary public elementary school, and in view of the additional expense involved can only be approved under exceptional circumstances." The shape and size of desks and seats need thorough reconsideration; those in use which satisfactorily comply with hygienic conditions are not numerous. It is to be hoped that in the near future this subject will be so treated as to insure many improvements.

One of the rules for *Higher Elementary Schools* is that no classroom should hold more that 40 scholars; this is a step in advance. Single or dual desks may be used, but it is suggested the former should be only 2 inches apart, with 2-ft. gangways between each pair of desks. As one of the reasons for going to the expense of single desks is to enable the teacher to keep the scholars apart or well away from each other, it would seem that an interval of 12 inches, with, say, 1-ft. 9-in. gangway, would

be preferable. This can be arranged in a classroom 22 ft. 6 in. by 20 ft., giving 15 ft. floor space each for 30 pupils. Another advantage possessed by single desks is that they can be readily adjusted to suit the height, etc., of each pupil.

Secondary Schools.—The rules for new buildings and equipment set a higher and more reasonable standard for buildings of this class. The floor space per scholar in classrooms (18 ft.) is rather less than in American schools, but seems extravagant in comparison with 10 ft. for elementary schools. Why a pupil in a secondary school should have nearly twice the accommodation of one in an elementary school is a question which deserves careful reconsideration. The 10 ft. now required in elementary schools represents only a slight advance beyond the 8 ft. which in the past was probably fixed by cost rather than by hygienic requirements; 15 ft. per scholar is a figure which gives good results; 18 ft. permits the children to be better isolated, but makes it more difficult for the teacher to be well heard by all.

The gangways in the cloakrooms should not be less than 5 ft. wide for girls. It would be instructive to compare the American practice of hanging the cloaks and caps against the classroom walls, or in recesses off the main halls, with cloakrooms as described in rule 5, well lighted and with means for drying damp clothes and shoes. A distinct cloakroom and lavatory for each classroom, separated from it by a wide corridor, is probably the best arrangement, though costly.

Hollow external walls are suggested, and artificial stone is apparently objected to. "Solid floors for the ground floor" are mentioned as desirable: it is questionable whether they are suitable in all situations, as, for example, in the fen-lands, clay valleys, or low-lying districts. In many cases a current of fresh air under the ground floor is much more acceptable from a sanitary point of view than a solid floor.

The rules as to windows are very good, one-fifth of the floor area is to be the area of the window glass. This is, of course, excessive for some situations, but it is reasonable as a minimum for others: one would have welcomed some elasticity in this rule. In America one-sixth is considered ample. It is not well to fix a hard and fast rule for the position of the glass line above the floor level. 3 ft. 6 in. is found by experience to be a more reasonable minimum than 4 ft. It will be remembered that formerly the usual distance for elementary schools was 5 ft., and the results were certainly not satisfactory.

The attitude of the Board of Education towards health questions is interesting and sympathetic, but open to criticism still on a few points.

In elementary schools damp, and often not very clean clothes, may be hung so close as to overlap each other, the rule being to place the hooks 6 inches apart, but in secondary schools, where the clothes are probably less objectionable, the hooks are to be 12 inches apart. Our cloakrooms are probably better than those in American schools, but the necessity for isolating and drying damp clothes, shoes, etc., needs more consideration than is usually given to it.

In secondary schools closets for women teachers and girls may be inside the main school building; it is not easy to understand why an exception should be made in the case of masters and boys.

Trough closets may be used in elementary schools but not in secondary schools. Divisions between w.c.'s may be 6 feet high only. When a separate window can be arranged for each closet, it is well to extend the partitions to the ceiling.

The children of elementary schools, who cannot always ensure personal cleanliness, may be packed close together in large classes, while the cleaner children of the secondary schools are to have nearly double the floor and breathing space allowed for the former.

As a whole the rules may be welcomed by sanitarians; they afford ground for hope that the Board of Education will use its influence judiciously in the direction of making every school a healthy workshop or dwelling. No doubt the Board will welcome and consider any suggestions this conference may produce.

The members of the Mosely Educational Commission seem to consider that there was nothing to learn from America in the matter of school buildings; most of them admired the architectural importance of the exterior of the schools, and the spacious accommodation of the interior. The buildings in New York were felt to be too large, averaging space for 2,500 scholars. The cost of school buildings in New York is about the same per cubic foot as in London; but the cost per pupil is £40 to £50, while here the cost varies from £12 to £20. The cost per pupil for secondary schools varies considerably according to accommodation and size. Recent high schools in America have cost from £50 to over £100 per pupil. In this country high schools vary from £30 to £70 per place.

The cost of schools will undoubtedly increase in the future, the standard of efficiency is gradually rising, probably larger classrooms will be the rule, giving increased floor space per pupil to allow of other than desk work to be done. The walls will have black boards on the surface, and space to get at them; floors will be of polished, jointless, non-conducting, noiseless material; greater precautions will be taken to prevent

dust production, and it will be possible to sweep with fresh air every portion of every room. In America, as much is often spent upon warming and ventilating a building as would have been spent on the whole building a few years ago.

Not only will the size of classrooms be increased, but rooms must sooner or later be provided to enable children of all grades to be taught how to keep their bodies and minds in healthy condition; workshops, baths, gymnasia, games and other means of recreation, libraries, dining-rooms, kitchens, playgrounds will be the rule, it is to be hoped, when we, here in Britain, have learned the lessons to be gathered from these invaluable reports; and when it is recognised here, as it is in America, that it is sound policy for the State to give to every child the best education he is fit to receive, under the most healthy conditions possible.

To those familiar with the school building of all grades of thirty years ago, the advance already made is encouraging, but there is at the present time a tendency to sacrifice essentials to non-essentials; an imposing ornate exterior has a certain educational value, but it is not so essential as ample internal accommodation, compactly designed to simplify superintendence and control. In classrooms capacity and light are more important than costly fittings or decoration; efficiently equipped workshops are more useful to science teachers than costly fitted show rooms, out of which pupils pass more or less incapable of working without the elaborate fittings which they have been accustomed to have at hand.

Referring to a Teachers' College in New York, a member of the Commission writes: "The whole building seemed to me to be out of character with the work to be done; far too ornate to please me." That is an exceptional view which indicates a danger to be avoided if possible. In this country we have not reached the "too ornate" exterior yet, but the internal fittings of some recent municipal schools are decidedly showy and unnecessarily expensive.

The Chairman, in introducing the discussion, spoke of the value of the more general advanced education of the American life as a matter for emulation for our country, rather than placing too much reliance on the technical branches. He thought that a greater knowledge of the world, of science, of health, and less linguistic education were to be desired for all; but that while technical education could do much for certain classes of our industrial population, it could do little or nothing for the mass of the population. "Huxley's ladder," as his scheme had been called, should doubtless be set up to reach from the gutter to the university, but it should be a very tapering ladder, the possibilities

of ascending it being very limited by the circumstances of life and the power of the individual. Referring to the Technical Education Commission, 1879, he drew attention to the fact that, while France, Germany, and Switzerland were ahead of us in technical education, still in every branch of industry except one this country led the van. And he considered our success to be dependent upon our geographical situation, the insular position, upon our geological constitution, the great coalfields, and our ethnographical construction—those racial characteristics which are not merely industrial, but also in other matters have allowed us to take a leading part in the history of the world. He thought also a great deal had depended upon the better feeding of our people as compared, not with America, but with other countries of Europe, and he desired to emphasise the fact that Feeding comes before Education.

Dr. T. Gregory Foster, (Principal of University College, London) referring to the Chairman's remarks and view of technical education, said that in the States it was not to technical education itself to which so much importance was attached as to the carefully graded system of schools that led up to the technical and university education,—a matter which had hitherto been missed in this country, so that students came up to these institutions unprepared to receive the higher education in its true sense of the word. The passing of the Technical Instruction Acts had brought the matter home, and had led to the Education Acts of 1900 and 1901, which gave at all events the machinery for better things. The powers given under these Acts to the county councils might lead to the careful grading of the various kinds of education, so as to lead to a wise organisation of the whole. In the question of the supply of teachers he believed that one of the reasons that made it difficult to find good teachers, especially men teachers, was that the conditions of work were for the most part so unhealthy. Whether in the great public schools, the secondary schools, or the elementary schools, the teacher was over-burdened with much teaching for which he was not really responsible. The healthy responsibility of the teacher had been taken away from him by generations of people who, instead of organising teaching, had organised examinations. At every turn in this country an examination is insisted on. These examinations are not conducted by the teachers, but by outside people who have either been failures as teachers, or who have never had the experience of facing a class. This sort of examining is an excellent form of business. Diverting examinations from their true work in education as part of the responsibility of the teacher into a business of financial profit to outsiders had resulted in putting a financial value on the examination instead of on education, and parents who grudged £5 or £6 a term for the teaching of their children, would willingly put down £5, or even more, as an examination fee for their children. Work, therefore, was no longer ordered and determined by the educational needs of the school. As a consequence the head teacher, the form masters and mistresses become mere machines set to prepare pupils for

curricula determined by people who have no business to mix in educational matters at all. The Board of Education and others are now considering how they can escape from the state of things that this excellent business of examining has brought about. The Middle Western States of America have solved the same difficulty that was threatening them by preparing a list of schools the curricula of which is approved by the Universities as a satisfactory preparation for university purposes, and admitting pupils who have gone through one of those curricula to the satisfaction of the teachers. This is known as the "accredited system." The University of London has made a small and timid beginning towards reform by allowing what it calls school examinations to be substituted for matriculation examinations. It does not touch the fundamental point of the accrediting system, namely, that under it the examining is controlled and guided by the people who have done the teaching. They ought to be trusted to do that out of their own desire for the welfare of their pupils, and of their profession. Until educational authorities are prepared to trust their teachers there will be a dearth of good teaching, because people will not undertake as their life-work spheres of action in which the full responsibility is not placed upon them.

Mr. Alfred Mosely (London) speaking from the position of a man who had seen and noted the results of education in other parts of the world, especially its effects upon commerce and industry, noted the difference in attitude of the English and American mind towards rational education. This he held to be the inducing of thought in the pupil and cultivating the reasoning powers in school life, thus rendering the average school-boy capable of developing himself still more when he had to fight his way and earn his living. With regard to the University question, Mr. Mosely thought it was still open to discussion whether those at Oxford and Cambridge should not be left, in fact, and others be built for the masses on the lines of the one at Birmingham. The training of teachers was a subject which was still in need of careful study, as England was as yet making no provision for this matter, at least, not according to American standards.

Prof. H. R. Kenwood (University College, London) urged the desirability of extended playgrounds, and the necessity of keeping them open all day to children in London, where suitable provision for recreation was by no means abundant. If the children were under some disciplinary supervision he held them to be a means of education as well as of physical health. He believed that the false system of teaching by cramming was due to the lack of trained teachers. Prof. Kenwood also spoke of the impossibility of properly ventilating the overcrowded school-rooms by any system of natural ventilation. Some mechanical means, he thought, must be used to make the air move sufficiently freely without giving rise to draughts, and there must also be provision for warming the incoming air in winter time. Prof. Kenwood considered the

trough water-closet a bad form for elementary schools, if for no other reason, because it did not supply the object lesson of pulling a handle in order to secure a flush of water to cleanse the receptacle; he thought all sanitary apparatus should afford an opportunity of giving school children object lessons in the elementary principles and requirements of hygiene.

Miss Ravenhill (London) thanked the Chairman for his reference to the value of co-operation between teachers and parents in the schools of the United States. She attributed a great part of the success of the teachers to the status assigned to them. She had been glad to find that physical exercises were required throughout the whole scale of American education, from the graduate at Clark University to the youngest child in the elementary school. In America children were not encouraged as in England to be in school at the age of three, but were allowed to develop a little physically and mentally before beginning school routine. She considered the careful decoration of class-rooms a forward step in practical hygienie.

Mr. Nesbitt (King Alfred School) spoke of the value to mental work of short lessons of thirty to forty minutes, with a run out of doors between each. Also of the effect of concrete and largely oral teaching for young children in keeping up interest and saving weariness in the pupil, thus giving more time for a fuller curriculum. He appreciated co-education as a factor in mental and moral healthiness of school life.

The Chairman, in closing the discussion, said that it was not so much the method, but the spirit with which the people approached education that made the vast difference between England and America, from the highest authority downwards. In this island he feared that education was thought still to be a bore —he was not sure whether that was not the phrase once used by a certain learned duke who presided over the Board of Education. But how vastly different was the spirit in America, where the great aim and object of life was to gain education, not for the material advantages which it brings, but because of the love of learning itself. It was customary to think of the American people as being engaged in the hot pursuit of filthy lucre. He assured them that nothing was less true than that. He had seen over and over again the national spirit deeply imbued with the love of learning for itself alone, and he thought the issues of that passion for Education were still in the future, as Mr. Mosely had told them, because with the American people, he felt, would lie the great destinies of the world in the present century.

Mrs. Meyerstein, Mr. Lionel Smith, Miss Findlay, Mr. Wolfe, Mrs. White Wallis, Mr. Garrod, Mr. Shepheard, Dr. Friedeberger, and Mr. Rose also spoke upon subjects more generally educational than hygienic.

WATER SUPPLY OF WEST AFRICAN TOWNS.

By HENRY REEVE, C.M.G.

THE question of a pure supply of drinking and potable water is one of the gravest importance to communities in any climate, and especially so under a tropical sun, where the average temperature of the water fits it as a medium for the propagation of innumerable species of bacteria and infusoria, some of which are injurious when taken into the human system.

It follows, therefore, that when water is collected for human consumption in the tropics, it is necessary that it should undergo a process of filtration before consumption, and, if possible, it should be protected from air and sunlight during the period which intervenes between its filtration and its consumption. The further precaution of boiling may be left out of consideration at present, as that process, although easy as regards individuals or households, is hardly practicable for the supply of a large community.

In countries where the natural formation of the land lends itself to the collection of the rainfall into streams, at a sufficient elevation to distribute to the community by gravitation, the filtration is carried out artificially, by the interposition of filter beds, of sufficient capacity, between the source of supply and the consumer.

In many of our African towns, however, this desirable conformation of the surrounding territories does not exist, and in West Africa especially most of the towns are on a sandy coast, or on small islands, near the main land, the soil of which is also sandy.

Free Town is an exception to this rule, and that community rejoices in an ample supply of water, caught in the valleys of the picturesque range which overhangs the town, and gives its old Spanish name to the colony.

The towns of Bathurst in the colony of Gambia, and Lagos in the colony of that name, follow the rule and are both built upon islands of sandy soil, with no hills or valleys of practical value as a catchment ground within 100 miles.

The water supply of these towns offered an interesting problem from

a scientific point of view, and especially so, because the Africans are as childishly careless about the purity of the water they drink, as about many other subjects, and they therefore require the protection of the European in this direction, to ensure both their own health, and also, to prevent them from becoming a danger to the community at large, by infection of their more careful neighbours. In dealing with the question of a pure water supply for tropical towns, it is the supply for the natives which is chiefly indicated as requiring consideration, as the European invariably drinks rain-water from his tanks which is generally boiled and filtered before use.

The well water is used for washing, and in many cases for cooking, and in this connection, the European would also profit by an ample supply of pure water for household and for general use.

Tanks.

The establishment by science of prevention of malaria, by the extermination of mosquitos, led to a careful study by Sir William McGregor, the Governor of Lagos, on the question of how to catch rain-water from the roof of a house and conserve it for future use, without offering an ideal breeding place to the insect-pest, which would practically always be within striking distance of its victim.

While every other water surface available for breeding mosquitos could be done away with, the tank remained a necessary adjunct to the houses of the European in tropical climates, for the storage of rain-water, as a provision for the dry season.

As a practical outcome of Sir William's study every government quarter, and many of the merchants' houses in Lagos, have been fitted with tanks, which not only prevent the ingress of dirt from the roofs, after seasons of dusty dry weather, but which also forbid the ingress of the mosquito to lay its eggs, and, should the eggs be washed down from the roof, the egress of the insect when developed.

Formerly the iron tank in a tropical sun, filled with pure water, formed the ideal warm-water nursery for the many pests which affect the comfort and endanger the life of the householder. To-day, however, the protected tank is another step towards prolonging European life in malarial countries.

The arrangement of the protection consists of—

(*a*) Wire gauze dome-shaped netting, which closes the head of the down pipe in the eave gutters, the mesh 100 to the square inch.

(*b*) An elbow inserted into the down pipe to form a riser for the column of water. The junction of the elbow and down pipe is also protected by wire netting, and in this case a finer gauze is used, 225 to the square inch.

(*c*) A wash-out elbow at ground level, which resting in a concrete drain serves to carry the weight of the pipe, and carries away the waste water when the flushing process is in action.

The delivery is controlled by a screw cap worked by a detachable key.

(*d*) An outlet or over-flow pipe from the tank, which is also protected by the finer gauze.

(*e*) An inspection cover which, fitted like a camp-kettle lid, prevents surface water from entering, and also is insect-tight by the nature of its construction.

The working directions are as follows: Before rain and after a dry period the plug at the bottom of the down pipe is removed, so that the washing of the roof is carried to the drain.

When the water runs clear the plug is inserted, and the water slowly rises to the level of the top of the elbow between the down pipe and the tank, then it begins to deliver from the point where the elbow joins the pipe. The floating matter and the scum are on the top of the column of water, while the heavier matter sinks to the bottom. The point of intake to the tank being between these two, the water entering the tank through the wire gauze is comparatively free from rubbish or silt.

Excepting in violent storms, when the water is agitated and the column exerts a great pressure on the gauze during delivery, the water enters the tank in a clean state.

When the tank is full and the storm continues, the service tap is opened and the old water in the tank, together with sediment, is flushed out, making way for the purer fresh rain-water.

The whole arrangement is simple in working, effective in purifying the water, and above all perfect in the prevention of mosquito breeding, thus completing the arrangements by which a house can be isolated from mosquito-borne malarial infection.

WELLS.

The conditions under which the natives of Bathurst and Lagos obtained their supply of water formerly are almost too insanitary to be

described in detail, and but for the special provisions of a hot sun on a sandy soil causing a rapid process of nitrification, together with the flushing of "everything" by the yearly rains, life would have gradually become impossible in these towns.

The first-named town is situated upon the sandy tongue of the Island of St. Marie, which practically forms the delta of the Gambia. The town, when the writer was there, was intersected by the heads of two swamps the banks of which became the latrine of the native inhabitants residing on their borders. The water in the swamps was tidal, but the filth was deposited in many cases above high-water mark, and the whole area was polluted.

The remainder of the town is built upon the sandy soil averaging about two feet above high-water mark, and sloping generally from the sea beach, which is comparatively high from the piling of the sand by the Atlantic rollers, down to the interior swamps above described.

On this slope the town rests, and the general water supply is obtained by digging through the sandy top soil, and in the private yards putting two or three barrels down to water level. In the public wells the sides are built, and during my stay the old wells were being gradually replaced by the new model of a self-sinking well, which will be described hereafter.

It will be recognised that the population of Bathurst resides practically on the cover of its own reservoir, the water of which is polluted by the filth of the people and animals, through the swamps above mentioned, as well as by cesspools which existed in the yards of the natives.

Efforts were being made in 1901 to improve these conditions by reclaiming the swamps in question, and by taking other measures to strengthen the sanitary environments of the town and population against disease.

The conditions of Lagos, a town with ten times the population of Bathurst and similarly situated on a sandy island, are, or were in 1901, practically the same as regards water supply.

We have the same swamps penetrating the island, with thick population round them. The water for the majority of the population is drawn from the wells which tap the fresh water at or about high-water mark, and, as in Bathurst, the town, with its numerous sources of pollution, is over its own reservoir for water supply.

The wonder is, not that epidemics of sickness occur in these places, but that they occur so seldom.

The ancient Lacustrian had a water supply under similar circumstances, but his lake was infinite compared with the population, and the

consequent pollution was therefore infinitesimal. In the cases under examination the area of water surface is practically the area of the town, and each resident draws from the water actually under his yard.

It may be of interest to some, who have not studied this particular phase of nature's provision for storage of rain-water, to describe the theory of its automatic storage.

It is easily understood how fresh water may be extracted from high sand hills, such as the dunes of Holland, from which both Amsterdam and Haarlem draw part of their supply, as this is the natural drainage, similar to a surface drainage into a rivulet or brook from a hill side, excepting that the drainage takes place altogether below the surface, and the artificial canal which is cut through the dunes plays the part of the brook.

It is not quite so easy of comprehension, however, when the whole of the area of an island is at, or nearly at sea level, to account for a storage of fresh water in the sandy soil.

The phenomenon was first observed by the writer many years ago in the islands in the Pacific, where the passing schooner and the canoe filled their water barrels from a sandy shore, or island, with very little trouble in digging. The observation of this led to the establishment of a well on the island of Nuhuloa in Fiji, where a coolie depot was erected to receive the lahores on arrival and departure from the colony, which yielded a good supply of good potable water.

The principles of storage of fresh water in sandy islands there observed were applied to several other colonies, and in the Gambia and Lagos the same source of supply was found to be in general use.

The factors governing the natural conservation of the fresh water in sand also exposed to saturation by salt water appear to be:—

(*a*) The size of the grains of sand of which the sea-shore is composed.

(*b*) The rainfall at the place governing supply.

(*c*) The rise and fall of the tide affecting the amount held up.

(*d*) The superior density of salt when compared with fresh water.

If we suppose a porous jar filled with fresh water and standing in a basin of salt water, it may be taken to represent a sand island in mid-ocean.

The rainfall on the sand above high water saturates the sand, equal to filling the porous jar.

The amount of water absorbed by the sand and retained depends upon (*a*).

The regular supply to be obtained depends upon (*b*) as to the periodic saturation.

The depth of the saturated stratum above low water during dry periods depends upon (*c*).

The quantity of fresh water held permanently in reserve below low water is due to (*d*), and this is again influenced by (*a*) and the presence or absence of loam or mud on the sea-shore, the action of which is to close the pores of the ideal jar.

In order to elucidate the presence of fresh water in the sand below the low-water mark of salt water, we will suppose the jar to have an impervious bottom representing in nature the finer sands and silts together with the marine plants and organisms which generally form the foundation of a sand island. Owing to the continual washing of the tides and waves during formation the larger particles are separated and sifted to the top, similarly to the particles in a sieve worked by hand or machinery.

In several instances known to the writer, this impervious stratum takes the form of a slimy quicksand, the slime being apparently due to the decomposition of shell-fish and organisms which flourished in warm shallow water, but which died when nature gradually superimposed another bed of sand.

Let us suppose the ideal porous jar to now be filled with fresh water and to be standing in salt water up to its medial line, evaporation goes on above this line, and gravitation forces the fresh water through the pores both above and below the medial line until a balance of forces is established, and the water inside the jar still remains fresh when the balance is established. The quantity remaining represents the reserve water which remains during the dry periods.

When the balance of power is established, the fresh water and salt water should meet at some point inside the porous material, of which the ideal jar is supposed to be constructed, but owing to the superior density of the salt water, and the consequent superior power of penetration of the fresh, this point is practically the outside film, and in actual practice the presence of seaweed algæ and slime on the bed of the sea form an effectual barrier to the penetration of salt water, so that fresh water may be obtained by digging on the slopes of a beach at low tide.

Another factor which keeps the balance in favour of the inside forces as regards level is the capillary attraction of the water, together with the power of absorption of the sand. These are dependent on (*a*) and in

laboratory experiments with the dry sand from the Lagos Water Works water was found to rise to 14 inches by capillarity, while 100 ounces of the same sand absorbed 26·8 ounces of water.

It is also owing to capillary attraction, that in places where the tidal range is low, say two to three feet, as in Lagos, the level of fresh water is maintained during the period of low water.

In actual practice, the sand is found to be saturated about one foot above high-water mark, and the level of fresh water in a well, under these conditions, during lengthened periods of dry weather, coincides, generally speaking, with high-water mark.

Where the rise and fall of tide is about five to six feet, as in the Gambia, the fresh water level is maintained near to low-water mark, and after lengthened dry periods there is a slight trace of salt in the wells on lower ground, those in the higher banks of sand retaining their freshness, although near to the sea-shore.

With the recurrence of the rainy season the island is practically afloat with fresh water, and the wells are refreshed, equivalent to refilling the ideal porous jar.

It will be seen from the foregoing that a beneficent providence has stored large quantities of fresh water near the salt water in places where it is absolutely necessary to animal life; and that, moreover, owing to the natural filtration that it has undergone in passing through the superincumbent strata of sand, its quality is superior to most river waters, which are subject to pollution both by exposure of surface, and by the population residing on the water-sheds.

Having such a source for water supply at hand it behoves man to take every precaution on piercing the surface against pollution from any source.

It does not follow that occupation of the surface would necessarily destroy the purity, provided that a sufficient depth of sand overlies the water, as in the two towns mentioned the surface has been densely populated for many years.

Penetration of the surface, however, for wells and cesspools, as described above, must necessarily poison the reserved water, and were it not for the heavy annual rainfall in these two places, the water would have become undrinkable and dangerous to animal life.

As to cesspools it is hardly conceivable that successive sanitary authorities should have allowed their existence side by side with the well from which the residents drew their water.

As to wells as formerly constructed, they constituted a danger, only in a less degree, as they were not constructed under supervision, and,

moreover, in many cases, were so constructed that the washings and filth of the surface returned to the well, while in the absence of any provision for pumping each customer brought his or her dirty or clean bucket and rope for drawing water.

The construction was, moreover, faulty; inasmuch as the sand which composed the filtering medium nearest to the well was disturbed by digging a large hole in which the well was built, and the outside was then filled in with the disturbed sand, together with brick and other débris, thus practically nullifying the benefits of the naturally deposited sandy formation as a filter.

The rain and surface water, of course, reached the water level in these wells, more readily down the side of the brickwork, and carried with it the slops made by the users of the well in washing their cooking utensils and feet, or in bathing.

In addition to this the structure itself was not impervious, and in many cases the water level was maintained by leakage through the sides.

The remedy to all these evils was found in the Self-sinking Concrete Well, with its pump equipment at such a distance as to forbid pollution from any surface sources.

It may be briefly described as a concrete cylinder, 4 feet in diameter inside, and 5 feet 6 inches on the outside, formed of rings which are 1 foot deep and 9 inches broad, cast in boxes to the proper curve, and rebated concentrically half the breadth. The ring is formed of ten blocks with radial joints, these may be also rebated, or joggled, if desired, in order to make the cylinder watertight at the greater depths.

The bottom ring is formed of blocks with a cutting edge on the outside made by casting the block with a mitre.

In building, the blocks are taken to the site separately, and a centre bar is driven into the ground on which an arm works on a collar in order to gauge the circle truly in building. Having struck the circle five feet six inches in diameter, the sand or loam is taken out to a depth of about eighteen inches and the ring of cutting blocks truly set in position.

The vertical blocks are then closed with cement mortar and the ten blocks are grouted up with cement.

The second ring breaks joint or bond and is similarly dealt with and so on until seven or eight courses are built like a column above ground.

The mason now fixes plumb bobs to the inside diameter at right angles, and digs away round the centre bar, continuing digging an inverted cone until the weight of the column exerts its power, and the cutting edge shears vertically, while the mitre throws the sand or loam inwards.

The process continues of clearing the centre, and gradually the column sinks to ground level, courses are added each day and allowed to set during the night.

When the cutting edge reaches the water level the sinking is automatic, and a bucket is used to take up sand and water combined from the centre, while the well gradually sinks to the desired depth.

It may happen that a quicksand is reached, and that therefore it is desirable to stop the well and sustain it in its position by nullifying the effects of the cutting blocks.

This may be done either by extracting them, inserting concrete slabs under them, or by completing the mitre of the cutting blocks by five radial slabs impinging on a concrete block as a centre.

The well then is floating upon the quicksand, and comes to rest permanently with half its bottom area available for supply.

It may be remarked here that by the adoption of this method of penetrating the stratum of filtering media overlooking the water-bearing formation, the former remains undisturbed during the process of sinking, and in fact, is left in a higher state of compression around the walls of the well than elsewhere. This process results in the prevention of percolation of water indifferently filtered down the outer circumference.

An improvement to these wells was made in Lagos by establishing the pump equipment at a distance of thirty feet from the well, by fencing in the immediate area around the well, and by covering over the top with an iron roof in addition to an insect-proof gauze cover.

Under these conditions, and given that it had not been previously polluted, the water should arrive at the surface as pure as that caught from a galvanized iron roof into a tank, for it must be remembered that in the tropics, even tank water is subject to adverse influences from dust and bird-deposits on roofs, and unless hermetically sealed is subject to contamination in the tank while awaiting consumption.

However satisfactory the well described above might be for a comparatively small community, it is evident that even given initial purity a town could not depend upon this source of supply for all its necessities in that direction, and in 1899, on the initiative of the Governor of Lagos, a scheme was evolved to extract larger quantities of water, from an area comparatively sparsely occupied, to the east of the town and on the Island of Lagos.

After examination and consultation with Mr. Osbert Chadwick, C.M.G., the Consulting Engineer to the Colonial Office, it was found that the area

available was insufficient for the supply of the daily minimum, and that, moreover, the scheme did not admit of extension in the future.

However, so much was done that it prepared the way for the larger scheme which is now in progress, and of which the final report is attached to this paper for reference.

The details given may be of use in future enquiries as to the possibility of a water supply from similar sources.

The whole scheme has received the approval of the Secretary of State for the Colonies, and the design for collection, pumping, and transmission across the lagoon to Lagos is now being formulated.

The new catchment ground lies on the main land opposite to Lagos Island, and it will be necessary to carry the supply across the harbour to the service reservoir in the town.

The line chosen intersects two channels navigable for large steamers, and will be two thirds of a mile in length from shore to shore.

On reference to the report it will be seen that the sand immediately below the water-bearing strata is extremely fine, and is, moreover, mixed with a species of China clay forming with it a quicksand.

In order to tap the largest possible quantity of the reserve water, the collecting pipes will be laid on this quicksand formation, and the difficulty of letting the water in and keeping the quicksand out will be met by floating the collecting channel on timber planking where it touches the quicksand.

The collecting channels will be laid down in the stratum of water-bearing sand, the bottom being about five feet below high-water level in the lagoon or harbour.

The surface will only be disturbed where necessary to this work in order to retain the great mass of filtering matter intact. Where disturbed the ground will be carefully made up with selected material, as nearly as possible in the layers as taken out of the trenches, and well rammed in order to prevent water entering the collecting channels which has not undergone effective filtration.

The collecting channels will run along the plateau, following a contour line on both slopes, so that the water entering will be taken from the central part when the plateau is saturated with rain, and will only draw on the reserve below high-water level during extremely dry periods.

The collecting channels will deliver into a receiving tank, from which the water will be pumped up a sufficient height to deliver into a service reservoir in Lagos, which will have a minimum head of fifty feet over any portion of the town, and about seventy feet over lagoon level.

The viaduct to carry the pipes across the harbour will be on screw piles above high water, across the shallower parts of the lagoon, with inverted syphons at the navigable channels. The syphons will have guard towers at each end, carrying electric lamps at night.

Two sites have been chosen for service reservoirs, which will command the whole of the town, for distribution to houses and standpipes, watering streets and flushing street channels.

The probable cost of the scheme, including house distribution for the town, where possible, and standpipe distribution to all native quarters and shipping at the wharves, is £100,000, equal, as regards the population, to a capital expenditure of £2 per head.

A water rate of 5 per cent., or 2s. per head per annum, would be required from the native population for standpipe distribution and sanitary purposes, which would be sufficient to pay interest on the capital, and provide a sinking fund, while the house to house distribution, on a higher rate or by meter, would pay working expenses, upkeep of plant, etc. With these provisions the waterworks should become a reproductive public work, and besides the incalculable benefit to health and life that it would bestow upon the population at Lagos, in time it will contribute a *considerable sum annually* to the revenue of the colony.

Lagos has now its water supply well in view, and it is to be hoped that a similar scheme will be applied to the Gambia, and other colonies or towns that still await the help of sanitary science, both for the preservation of human life and for their progress towards civilization.

It is by these and other scientific works that we mark step by step the progress of the dark continent towards the enlightenment of European nations. The greatest teacher that mankind has ever known has said, "By their works ye shall know them;" and in the humble conscientious opinion of the writer, it is by these works that European nations can justify their interference with the lands and lives of the Africans, and justify their presence there in the sight of the Creator of the universe.

SOME PRESENT-DAY ASPECTS OF CONSERVANCY SYSTEMS.

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(Fellow.)

Read at Sessional Meeting, Nottingham, November 26th, 1904.

BY dry or conservancy systems of excrement disposal we understand those systems which have for their aim and effect the reception of nightsoil into cavities or vessels attached to domestic closets; such nightsoil being removed and variously disposed of from time to time, by public or private scavenging. The receptacles in use at the present day are midden pits or bins, and pails of various patterns and sizes, with or without absorbent ashes, or other material, such for instance, as peat (Goux system), sawdust, earth (Moule's closet), charcoal (Stanford's closet).

Viewed from a simply theoretical standpoint, these dry systems appear in all respects excellent. Regarded thus, they seem to satisfy alike the essential requirements of decency, sanitation, and scientific economy. Privacy, decency, and cleanliness are secured by proper construction in the first instance, and by subsequent supervision, and frequent, complete, and careful scavenging. Last, but certainly not least in importance, the invaluable fixed nitrogen contained in the dejecta is by these systems conserved for utilization upon the soil as a food for plants. Sir William Crookes, Dr. Vivian Poore, and many other scientists in this country and abroad, have argued strongly on these lines for the continuance and extension of conservancy systems, and it cannot be denied that they have made out (in theory, at least) a strong case in their favour. They have stated, with perfect truth, that the loss of nitrogen available for plant life involved in the destruction or dissipation in water of nightsoil was irreparable. Examples of the successful management of conservancy systems, together with the extraordinary benefit accruing to local agricultural operations, through the manurial use of dejecta, have been cited

from regions as wide apart in space and circumstances as China and Holland. The nightsoil is removed in civilised countries, we must remember, by road, rail, and canal, to agricultural districts, and there utilized as manure. The methods of removal in uncivilized countries are more primitive, and, consequently, in most cases more objectionable than in the civilized. We are told by Dr. Poore and his school that what is possible in all that constitutes the good management of dry closets in Holland and in Hampshire (Andover) is also practicable (for capable people endowed with the power of organisation) in the case of huge cities.

It should not be forgotten, however, that conservancy systems do not commonly secure the preservation of more than a fractional part of the most valuable manurial constituent of nightsoil, the urine. This fact is frequently lost sight of by the apologists of the systems.

Again, the admixture of ashes, sawdust, peat, and other absorbents, together with domestic detritus as various as old umbrellas and biscuit tins, with the nightsoil, which goes on to some extent in most towns and districts, entails a large amount of subsequent screening before the nightsoil can be advantageously utilized as manure.

The only alternative to dry systems is, of course, water-carriage. Ordinary w.c.'s or well made fresh-water latrines are the best closets, and people must be educated to use them intelligently. That this education can be accomplished with even the lowest class of the community is evidenced by the fair condition in which such closets are kept in the slums of cities like Liverpool and Glasgow. I inspected a large number of the poorest tenements in Glasgow with Dr. Chalmers and other gentlemen in July of this year, and found the w.c.'s in every instance in good working order, and much cleaner than I expected. I was told that this comparatively satisfactory condition was due to the fact that each flat has its separate private w.c. for the use of the family or families resident on the flat, that the latter are responsible for its decent maintenance, and that the arrangement on the whole works extremely well. Such an example as this, is, I think, sufficient answer to those who contend that ordinary w.c.'s are inadmissible for the poorest slum property.

With regard to the ultimate disposal of water-carried sewage, we have (1) discharge into water courses (now practically abandoned) and into the open sea; (2) broad irrigation and downward filtration; (3) bacterial treatment and filtration; (4) chemical treatment and filtration—and combinations of these.

Before proceeding to discuss dry systems, more particularly in the light of modern knowledge and experience, I may remind you of a few

historic facts concerning them. In the first place they have a very ancient history, their institution, so far as man is concerned, being coeval with man himself. Long before the establishment of a regular "cachus" or "jakes" or the use of cloacæ, our forbears dug their motions into the soil, as men do still in most uncivilized countries, and as many animals also do. There can be no doubt that the careless management of dry systems in crowded communities led to, or fostered, many of the terrible epidemics of ancient times; and, coming towards modern days, we find in the letters of Erasmus allusion to the Stygian filth of ordinary human dwellings in the middle ages, the urine of men and animals being often allowed to soak into the floors of living rooms and the ground around the precincts of dwellings.

Dr. W. P. Mears and other writers have told us of the disastrous results of attempting to carry out the economic disposal of human dejections on a large scale in China, in the paddy fields around large cities; and the filthy picture of the dry closets of our camps during the South African War is fresh in the minds of us all, with the terrible mortality from enteric fever which affected all sections of our army at the front.

A few years ago I wrote a report upon "Some Points in Connection with Conservancy and Water-Carriage Systems for the Removal of Excreta in Seventy-eight of the Larger Towns of Great Britain and Ireland." In this report I was enabled by the courtesy of my colleagues in other towns to give a fairly accurate account of the systems of excreta disposal employed in the great towns of the three kingdoms. I found that some hundreds of thousands of midden-privies and pail-closets were in use in these towns, but that except in some half-dozen towns of Yorkshire and Lancashire (of which I think Hull was the only one with a population of as much as 100,000) dry closets were condemned, and their conversion to w.c.'s was stated to be only a matter of time.

The fact that these closets were almost universally condemned by medical officers of health and other officials who had had experience of their working on a large scale, and for practically the same reasons in each case, went a long way towards convincing me that in this country at least their days were numbered. It was said of them (*a*) That they were barbarous and indecent survivals of a less civilized period; (*b*) That their use was always, but especially during hot and dry weather, detrimental to the health of the community; (*c*) That it was practically impossible with any reasonable outlay to maintain them in decent condition in very poor neighbourhoods; (*d*) That the satisfactory economic disposal of night-soil in the rural districts outside the towns was an ever-increasing difficulty.

Each of these counts affords an excellent text for a separate philippic against these dry closets.

With regard to the first count, their offence against decency, there is much more than a simple sentimental objection to be urged against them. The essence of modern sanitation is cleanliness, and how can cleanliness be effectually inculcated with such a filthy object-lesson as the privy-pit or pail continually under the eye and nose? with air and soil continually polluted by foul soakage and effluvia? with flies and dust in warm weather constantly reminding the senses that an accumulation of fæcal matter exists in the immediate vicinity of the house? It is often said that people can get used to anything. It is true, they can; they can even become so accustomed to filthy surroundings that they feel no annoyance from them; but if they grow callous to such discomforts as these, it is at the expense of self-respect and a proper sense of decency. It is mainly by the cultivation of such thoughts prompted by feeling that the poor of our slums must be elevated, and I cannot think of anything, within the official purview at least, more calculated to discourage the cultivation of such finer thoughts and feelings than any suggestion of gratuitous indecency connected with the means of relieving nature.

Now, with regard to the question of injury to health. Upon this point as you know, I have already expressed my opinion pretty plainly upon many previous occasions, and I will here only remind you of a few salient facts connected with the question. We know something of the part played by fæcal organisms (*e.g.*, Eberth's typhoid bacillus and the colon group of bacilli) in the production of disease, and we know that they abound in the fæcal-polluted air, soil, and structure of these closets.

I have not brought with me any of my office spot-maps shewing the incidence of disease in this city, but you may take it from me that the enteric fever maps (and in a less degree those for epidemic diarrhœa) shew a striking correspondence between the distribution of the disease and of the dry closets, especially in the poorer districts.

Again, it has been quite impracticable in some recent past years to get rid of all our night-soil immediately after collection, and large accumulations have occurred in the city. There is not the slightest doubt that the incidence of enteric fever was persistently much heavier in the neighbourhoods of these accumulations than elsewhere.

You may say that such storage of night-soil was indicative of mismanagement. It may be so, but under the circumstances the mismanagement was unavoidable, and, with a continuance of our dry system, we should have to stock our night-soil again if we could not get rid of it. And

further, given a recurrence of the comparatively high temperature and low rainfall of several recent past years, we should certainly have a repetition of our very serious troubles with enteric fever in these years if we failed to send away this class of refuse immediately after collection.

A great deal has been said and written, especially of late, about the action of rats and flies in the propagation of disease, and these pests, under favourable conditions, are among the commonest incidentals of dry closets. I have known many instances, too, in which the infection of enteric fever has apparently been carried directly by infected closet pails. It must be borne in mind that it is quite impracticable, as a matter of routine, to disinfect the dry-system receptacles, whether pails, pans, or pits.

I shall now say a few words upon the question of how far it is possible for the local authority to secure the decent maintenance (apart altogether from disinfection) of these dry closets in very poor slum districts. Speaking after considerable experience, I say at once that, without an altogether disproportionate outlay, this is impracticable. Many schemes have been tried for keeping these slum closets in decent order, but all have failed. The explanation probably is, that the ordinary dry closet is such an unsavoury object that the very poor will take no pains to minimize the nuisance which, in some degree, is inseparable from its use. Of course I do not say that these closets are responsible for all the filthy habits of the slum denizens. I only contend that there is nothing in this class of closets to encourage the very poor to cultivate habits of decency and cleanliness in obeying the calls of nature, and that the closets and their surroundings are consequently often in a scandalously filthy condition.

The last point with which I have to deal is the disposal of the nightsoil after collection. It is the ever-growing difficulty of disposing of the nightsoil to farmers and others on reasonable terms, together with the also growing objection on the part of residents in districts through which it passes in transit, which have done more to induce local authorities to abandon dry closets than any of the arguments against them I have previously mentioned. In many districts it has even become necessary to burn the nightsoil in order to get rid of it.

The destruction of nightsoil by fire is indeed a "pis aller," which destroys also the only valid argument in favour of dry closets—the argument that their use conserves the fixed nitrogen of fæcal dejections (urine and fæces) for the benefit of vegetation.

The number of pail-closets in Nottingham is now about 37,400. The

ANALYSIS OF RETURNS OF TOWNS IN WHICH THE CONSERVANCY SYSTEMS STILL SURVIVE.

The following is a list of most of the principal towns in which conservancy systems still survive, to a considerable extent, with their populations, the number of midden-privies and pail-closets in each, and their decennial enteric fever death-rates :—

Name of Town.	Estimated Population, Middle of 1904.	* Number of Midden-Privies.	Number of Pail and other like Closets.	Average Annual Death-rate from Enteric Fever, 1893—1902.
Aston-Manor	80,363	10,000	—	0·21
Belfast	358,680	30,000	—	
Birmingham	537,965	11,500	33,000	0·22
Bolton	175,744	14,700	6,759	0·29
Bradford	285,089	30,000	—	0·18
Burnley	100,569	4,684	904	0·23
Burton-on-Trent ..	51,934	3,817	4,576	0·14
Derby	120,449	7,275	4,777	0·21
Gateshead	118,067	6,000	10,000	0·16
Halifax	107,580	1,500	13,373	0·17
Hanley	63,932	3,270	3,440	0·22
Huddersfield	94,925	2,000	15,000	0·14
Hull	253,865	47,500 (of all sizes)	100	0·25
Ipswich.....	69,805	9,600	90	0·21
Leeds	450,142	17,214	1,413	0·20
Leicester	224,186	2,080	7,639	0·16
Manchester	557,938	23,223	78,726	0·19
Middlesbrough	96,684	3,400	8,195	0·32
Newcastle-on-Tyne.	225,362	2,900	4,300	0·15
Norwich	115,538	12,000	3,500	0·22
Nottingham	248,811	500 (circa)	40,253	0·30
Oldham.....	139,497	76	23,381	0·14
Preston	115,055	20,000	—	0·31
Rochdale	85,601	120	13,593	0·11
St. Helens	88,545	5,021	6,727	0·45
Salford	228,983	13,983	8,990	0·35
Sheffield	432,940	20,000	—	0·29
South Shields	107,334	11,150 (of all sizes)	—	0·26
Stockport	97,008	6,000	—	0·20
Tynemouth	53,060	2,000	3,000	0·13
Warrington	67,331	30	10,506	0·17
West Bromwich ..	67,186	7,000	—	0·22
Wigan	62,800	64	8,400	0·26
Wolverhampton ..	98,194	—	14,000	0·29
York.....	81,268	7,787	61	0·24

Average annual death-rate from enteric fever (1893–1903)
in 33 great towns = 0·20.
Do. do. London = 0·15.

Pail system in Nottingham.

The majority of these towns contain a larger actual number of privies than Nottingham, but Manchester alone has more pail-closets. Nottingham is peculiar and fortunate in having so few privies. The pail system was adopted by the Corporation here in 1868, and from this date onwards the work of conversion was vigorously pushed forward until practically complete.

* There are two privies to one pit in most cases.

midden-privies number only about a couple of hundred. The amount of nightsoil annually collected amounts to about 55,000 tons.

With this brief introduction I leave this important subject for discussion, and will only express the hope, in conclusion, that this sessional meeting of The Royal Sanitary Institute may be instrumental in helping on the conversion of our pail-system of excrement disposal to one of water carriage.

The Mayor of Nottingham (Alderman Bright, J.P.) said that, so far as the city was concerned, they were always, he might say, interested in anything which would promote the health of the inhabitants, and he knew that not only the city of Nottingham but the whole of the United Kingdom was very much indebted to The Royal Sanitary Institute for the numerous schemes they had devised for the improvement of the health of the residents in large towns and cities. He did not pretend to be an expert in any sense in sanitary matters, and he noticed that the title or subject of Dr. Boobbyer's paper was "Some Present-day Aspects of Conservancy Systems," but he could say that Dr. Boobbyer had rendered very long and very efficient service to the city of Nottingham. He was very enterprising, able, and industrious, and to him Nottingham was indebted in no small degree for the good health of the town. It was a very healthy town, and compared favourably with most cities of similar size in the United Kingdom. The city was naturally well situated, had a very good fall for its sewage, had a river running close by, the ground was largely composed of sandstone, and they had an excellent sewage farm within a distance of three or four miles. Although he had said Dr. Boobbyer was enterprising and able, he was afraid the ratepayers, or at any rate the owners of property, fancied they had some cause of complaint against the Health Department. This was based on the fact that during the last thirty years there had been no less than three systems of dealing with the night soil. First they had the ash pit, which was, he thought, denominated the midden (up to 1868), then they had the pail-closet, and now there was the proposal to have a universal system of water-closets in the city. There was no doubt whatever that the last-named was the best system, and the one which most tended to the promotion of health. They must, however, bear in mind that the second system having been established at the expense of the owners, it was regarded as hard lines that those owners should have to bear the expense of a third system in order to keep up with the progress of sanitation, especially as they seemed to think a fourth system might yet be discovered. He had no doubt, therefore, that The Royal Sanitary Institute would have due regard to the pockets of the owner in any proposals they had to make. He was under the impression that water-carriage was the best possible plan in the case of towns near the sea, and also that it would be the most desirable one in the case of inland towns if it were

not for the difficulty, in their case, of the disposal of the sewage. Notwithstanding opinions to the contrary, he could not help thinking that sewage farms in the centre of the country, especially when attached to cities, where manufacturing refuse had to be dealt with, would prove to be only a temporary measure, unless the extent of the land forming the sewage farm was enormous, because when the water-carriage system was introduced in a city like Nottingham the amount of liquid to be dealt with must in time be more than could be coped with by the farm. He would only say, in conclusion, that they were delighted to have such a distinguished company here, and that he hoped their deliberations would result in some practical good. He did not know whether the members of The Royal Sanitary Institute annually paid a visit to large centres, but if so, he ventured to express the hope that before long Nottingham might be honoured by another visit from them.

MR. COUNCILLOR COOK (Vice-chairman of Health Committee, Nottingham) said the science of sanitation did not occupy the minds of their forefathers as it did the minds of the present generation, for the simple reason that the population of our cities was very small then compared with what it is now. It was only recently that the population of the country places had begun to pour into the towns in consequence of the establishment of factories, and it was this influx that had brought the question of sanitary reform to the front. Only a few years ago Nottingham was a comparatively small place, and privies a few yards from the back-doors of houses were then considered sufficient: but as the population became thicker the question of sanitation became more and more pressing. A system of pail-closets was then considered the best thing to adopt, and this system, with the frequent removal of night-soil, was better than the old privies, which were only emptied once or twice in the twelve months. But now they were getting more enlightened. They found that the pail-closet system was not perfect after all, and that it was desirable that they should adopt improved methods. In his opinion, and in the opinion of the Health Committee, the water-carriage system was the best. The alteration from pail-closets to water-closets would be very expensive to property owners, and the question arose as to whether the Corporation would expect them to bear the whole expense. There was also the question of the cost of water, which would have to be used extensively, and he thought a diminished rate, or no rate at all, should be charged for the water used in water-closets. They were very fortunate in Nottingham, as shown by a recent report with regard to their sewage farm, in being able to dispose of all the sewage of the town without any difficulty. The ground absorbed all the sewage, and after millions of gallons of liquid had been received by the land, it was found that a few feet below the surface the effluent was so pure as to be almost drinkable. Another question which arose was that of destructors. When he first became interested in the public life of the city of Nottingham, it was a matter of very

great surprise to him to see thousands of tons of refuse, collected during many years, lying in large heaps in the town. There was no doubt that enteric fever had arisen close to the refuse heaps, owing to the contamination of the atmosphere in those localities. By the provision of destructors, they had got rid of most of the accumulations, and now destroyed the refuse as it came in, and to aid them in paying the expense they were making use of the power produced by the burning of the refuse for the production of electricity. They were called a spending committee, but it should be taken into account that they got steam for the generation of electricity when burning the refuse, and he thought they were making very good use of their opportunities of effecting a saving in this particular instance.

Dr. Dabell (Sheriff of Nottingham) said it was hardly necessary to remind members of The Royal Sanitary Institute that epidemic diarrhœa was very different from that caused by eating fruits or other irritants. Epidemic diarrhœa had of late years come to be recognised as a totally different disease, as different as typhoid fever was from typhus fever. He wished to point out one or two peculiarities of this disease of epidemic diarrhœa. It was only prevalent to any extent in the hot summer months ; the mortality from the disease was almost entirely confined to children under one year of age ; more than half the deaths occurred in children under six months old ; it was seldom seen in the better districts, supplied with a water-carriage system ; it rarely occurred amongst infants who were entirely breast-fed ; and it occurred mostly in densely occupied districts. Taking into account these considerations, the field of observation was a good deal lessened when they endeavoured to find where the cause of the disease lay. One naturally had to come to the conclusion that the cause lay in the air which these children had to breathe, and in the food they had to eat. His opinion was that it was largely due to the milk upon which they were fed. He did not say the milk was necessarily impure when it reached the homes, but it became impure afterwards. In his own practice, when he had insisted upon the milk being kept aseptic, the results had been better than when this point had not received attention. The latest statistics go a very long way to show that wherever privies or pail-closets exist there is a very high infantile death-rate during the third quarter of the year. In proof of this, he would quote the following statistics :—

	Number of Privies.	Number of Pails.	Average Diarrhœa Death-rate for ten years during the third quarter (hot summer months).
Birmingham	11,500	33,000	3·8
Hull	47	100	4·8
London	—	—	2·4
Liverpool	—	—	4·4
Nottingham	500	40,252	3·7
St. Helens	5,021	6,727	4·3
Salford	13,983	8,990	4·6
Sheffield	20,000	—	4·8

Now it would be very interesting to compare these figures with those relating to cities, which have an up-to-date water-carriage system of excrement removal. He would only refer them to London, where the average death-rate during the third quarter of the last ten years had been as low as 2·4, and one could not help thinking that there must be some connection between this epidemic diarrhœa and the pollution of soil and air caused by privies and pail-closets. It had been said, and to some extent rightly, that infantile diarrhœa did not begin unless they had a very hot, dry summer. They certainly got less of it in a wet summer. It stood to reason that these pail-closets caused a great pollution of the soil and air, consisting largely of the bacterium contained in human fæces, and it had been shown that when this bacillus was cultivated at about the same temperature as they found in large towns, and injected into animals, it produced very severe diarrhœa. Dr. Boobbyer contended that wherever there were a lot of pail-closets you were sure to get this diarrhœa. If there was this connection between infantile diarrhœa and pail-closets, they had here a very good reason for altering the system. With their decreasing birth-rate anything that could be done to reduce the infantile death-rate should be done. He did not think the property-owners should bear the whole of the cost of making the alteration; the Corporation should bear some part of it. In Burnley the Health Committee purchased the fittings and said to the owners of property, "If you will put these in we will give them to you," and in that way many closets were converted. That was a plan which he thought was worthy of consideration, and might well be followed in Nottingham. In the case of slums one hesitated whether any large amount should be spent in this direction either by owners or the Corporation. He thought back-to-back dwellings should be gradually included in condemned areas, and that their efforts should, for the time being, be confined to districts inhabited by decent working men.

Dr. J. R. Kaye (West Riding C.C.) said that in testing the value of any system of conservancy they should have regard to the following considerations:— That it should be convenient to the householder for the deposit of excrement; that it did not offend the senses; that it did not pollute the air, soil, or water; that it permitted of the removal of filth with regularity and promptness, and without undue labour; that it was not expensive and did not occupy too much room; and he thought it was most important that it should be adapted to the class of community it had to serve, whether in city, town, or rural district. It was quite reasonable to say that no method complied so fully with all these requirements as water-carriage and the removal of dry refuse in removable receptacles. It might be said that in connection with a water-carriage system there must be a good supply of water and a good system of drainage. He said that a proper water supply and a proper system of drainage is necessary for the needs of any population, and that those things are therefore necessary no matter what the conservancy system might be. In the West Riding of Yorkshire a

large number of water-closets were being provided, and there was an annual reduction of the privy system. In the outlying districts, however, the Local Government Board would not insist upon water-closets if an owner opposed their introduction, but he was anticipating the time when a great many of these privies would be superseded by water-closets, which were absolutely necessary in the West Riding, where a number of districts were passing from rural to urban. He was glad to hear the Mayor and one or two other speakers say that in Nottingham they were intending to introduce the water-closet system as far as possible, and even if they had to assist property owners to some extent, they would find there would be an ultimate saving. In one town which he knew they spend £7,000 a year in emptying tubs alone, and if they would give something to the property owner, or provide w.c. fittings without charge, they would in a few years save the whole of that amount. As sanitarians, they could only have one opinion as to the great number of pails in use in a place like Nottingham, and he heartily agreed with the condemnation of such a system expressed by previous speakers.

Mr. H. Gilbert Whyatt said the problem could be divided into two forms as far as towns were concerned. There was the lesser problem in towns, where water-closets were universal, and there was conservancy of dry refuse only. The greater problem existed in towns where water-closets were in a minority, and both nightsoil and dry refuse had to be conserved. Grimsby had, unfortunately, to face the greater problem. They had over 9,500 privy-boxes, and only 4,500 water-closets; but he was thankful to be able to say that there were not twenty-four middens in the town, and so far as he could gather they had never had many. They had but few slums, and no back-to-back houses. The dry system might be very good in Andover and other small places. A friend of his, who lived at Iburndale, in Yorkshire, provided boxes for the village, and sent his gardener for the nightsoil, which was dug into the garden, and it paid him; but that kind of system was impracticable in towns of from 5,000 to 500,000 inhabitants. The pail system in towns was bad; it was neither satisfactory nor sanitary. They could not help admitting, however, that it was an improvement on the middens, for the excreta were removed more easily, more frequently, and with less nuisance, and there was less danger of percolation into the surrounding ground, or of the pollution of both soil and air. The feeling of his Council was that it was about time the privy-boxes were abandoned, but there remained the question as to who should bear the expense. He hoped the day of pail-closets would not be a long one, and that water-closets would be adopted, for that substitution would do away with one of the greatest difficulties with which borough engineers and scavenging inspectors had to contend. He agreed that the manurial value of the night-soil was not great, and it was nasty to store, nasty to get to the country districts, and nasty when it got there.

MR. A. J. MARTIN (London) said he would like to point out that the favour with which the conservancy system had been regarded in many quarters was based on a mistaken idea as to facts. It was assumed that the whole of the manurial value of the night-soil was retained by a dry system, and that with water-carriage it was lost. The conservancy system, however, was only successful as regards the solid portion of the dejecta, the manurial value of which was only one seventh or one eighth of the whole. It was a mistake to assume that by putting the excreta on the land the whole of this value could be recovered. Fæcal matter could only become available as food for plants by decomposition, and it was doubtful whether they got more for the national good by conservancy than by water-carriage. And, after all, the consideration of economy should be a secondary one; the health consideration should come first. With regard to economy, they had to remember that while they knew the direct cost of a good system of dealing with night-soil or sewage, they did not know the indirect cost of a bad system. Anything which was bad from a health point of view, was bad also from an economic point of view. If the cost of the bad systems, in avoidable illnesses and deaths, was generally known, the work of sanitary reformers would no longer be hampered as it was by lack of public support. There was something absolutely loathsome in the storage of dejecta near houses. Food supplies were often kept within a few yards of the excreta, and flies frequently conveyed pollution from the night-soil to the larder. He had no doubt that many mysterious outbreaks of illness could be accounted for in that way. He entirely sympathised with the Mayor of Nottingham in the apprehension which he had expressed on behalf of property owners, who had already had to install two systems of dealing with excreta, as to the permanence of the third system which was now recommended. It was very natural that they should hesitate to adopt anything which was likely to give place to something else, but there could be no doubt that the water-carriage system had come to stay.

MISS EVANS (Nottingham) said that, apart from the practical side of the question, there might be something to be said from the sentimental point of view, which she was supposed to represent. There must be some consideration for the lives of those poor people who have to use these so-called conveniences, which in Nottingham were anything but conveniences. Those of them who had seen a little of the female population here knew how much they must suffer because of the close proximity of these conveniences to the houses, and the consequent detriment to their efforts at housekeeping. They could not possibly keep their food properly, or teach their children to be clean and observe the rules of health. The people were packed so closely together that one yard, with a convenience common to all, had to serve several families, and in these circumstances a sense of decency could not exist. If they were to train them to be clean, and therefore to be healthy, they must give them something better than the present system.

Mr. C. Mason (Beeston) said he took it that it was simply a matter of the amount of the population of a place as to whether they should have a dry system or water carriage. He did not see how they were to have a water-carriage system in a very small village. It was a question of evolution, beginning with the system of Moses, then middens, then pail-closets, and then water-carriage, and he thought the last-named method should be adopted throughout the country wherever practicable. The question of transformation was the one to which attention should be devoted more than anything else. That was where the difficulty lay, and the point of cost had not been touched upon to any great extent by the author of the paper. He thought it was not right for a property owner to have to bear the expense of alteration twice in the course of a few years at the dictate of any health authority.

Dr. Robertson (Birmingham) said his first appointment as a medical officer was in a town where dry closets were in existence, and the local authority there had the greatest anxiety with respect to ever recurring outbreaks of typhoid fever. In various parts of the town there were privies, pail-closets, and water-closets, so that comparative statistics were available for compilation, and the deductions to be drawn from these were absolutely convincing as to the undesirability of the dry system. He was not now able to quote the exact figures, but roughly they showed that the enteric-fever mortality was about five times as great in houses provided with privies, and three times as great in houses provided with pail-closets, as it was in those houses which had water-closets, whilst the proportionate number of cases of sickness in the former dwellings was even greater. He had continued to watch that town for many years, and he had found that as the number of water-closets increased the typhoid statistics improved. There could be no doubt that wherever the storage of filth near dwelling-houses was abolished typhoid was reduced, and a similar effect might be observed with regard to a large number of other diseases. His only concern was that at the present time middens and pail-closets were not being abolished at a sufficiently rapid rate, for his experience in Sheffield and Birmingham was similar to that which he had in the town to which he had already alluded. He would recommend that even in the poorest slum districts water-closets of a first-class description, with really good fittings, should be provided. Inspectors should be employed at the outset to go round once a week or fortnight to see that the closets were kept thoroughly clean, and they would find that when once the system had been properly started it would go on successfully. He did not believe that pail-closets were suitable for any large town.

Mr. Councillor Lloyd (Nottingham) said he represented a portion of the slum district of Nottingham, but although the people there might be rough they possessed a great deal of sense. He was pleased to say they had started sanitary reform there by the introduction of water-closets, and at first they had

very great trouble. One difficulty was that the landlords said they would raise the rents if water-closets had to be put in; but that had not come off. The people did not know then what these closets were; but if they now took the opportunity of going round and inspecting them the people would tell them that they were the greatest boon they ever had. They would see that even the houses were not kept as clean as these closets. Even in the back-to-back houses and common lodging-houses they were asking how long it would be before they could have the same system.

DR. HANDFORD (Nottingham C.C.) said his experience in the County of Nottingham had been unfavourable to these closets. In the country districts they had to contend with many difficulties in connection with the pail-closet system of conservancy—difficulties which did not exist in the towns. In many of the districts the water supply was unfortunately too limited to allow of the introduction of a water-carriage system, and that was one of the things to which they must look in the future. He considered that the pail-closet was simply one stage in the development of sanitary progress, but he did not always look upon it as a stage in advance. In some respects it had been retrogressive. In districts where the local authority were too small to employ their own staff to empty the pails, and a contractor had to be employed, or the adjacent farmers undertook the duty, the system had proved a retrograde step. It was a matter for regret, too, that when the water supply was abundant the present generation appeared to be content to rely upon the conservancy system. He had little hesitation in saying that the conversion of the dry system into water-carriage was more a question of education than of expense, and in his opinion that education should start in the public elementary schools. They ought not to be content to provide those schools with sanitary arrangements which would just meet the requirements of the sanitary authority. The sanitary arrangements should be models for adoption by the surrounding district, and should be regarded as part of the education in hygiene, for the children in the schools of to-day would be the working people and ratepayers of to-morrow. It was only by means of education that the change to a decent method of removal of excreta would be accomplished. In his judgment this was not merely a question of tub-closets *versus* middens or water-closets, but one of cleanliness, decency, and the destruction of rubbish. Rubbish was allowed to accumulate because that had been the custom. In the most beautiful villages they could hardly see a stream into which broken pots and pans were not thrown. In ancient days that would have been considered a desecration, but now it was a common and growing practice. In small villages the rubbish should be periodically burned by travelling destructors, and he had no doubt that fire would be the great purifier for the coming generation.

Dr. F. W. Martin (Brighouse) said that Brighouse, which was a factory town in the West Riding of Yorkshire, had passed through all the different stages of conservancy. Midden privies were followed by pail-closets, and within the last five years they had had sewerage works established at a cost of £150,000, and he was pleased to say they were working satisfactorily. Property-owners had gradually been brought to see that the water-carriage system was the best, and he was glad to be able to state that water-closets were now being provided wherever practicable. The cost of the removal of the contents of pail-closets was a very heavy item in the expenditure of any local authority. This was realised at Brighouse, and it had been decided to provide the water-supply free to one closet in any house, a charge being made for extra closets. The owners of factories were also providing water-closets for the use of their employees, and in these cases the water was paid for by the local authority. He could point with pleasure to the fact that the incidence of enteric fever and diarrhœa in Brighouse had been very much lessened in the past five years. In 1902, when the population was roughly 22,000, there was only one recorded death from diarrhœa. The death-rate of Brighouse last year was slightly under 12 per 1,000 of the population, and he had reason to believe that that result was in a great measure due to the reduction of midden privies and pail-closets.

Dr. Boobbyer (Nottingham), said there was very little for him to say by way of comment on the discussion, as most of the speakers agreed entirely with the statements contained in his paper. In speaking of the economic disposal of night-soil he was quoting from Dr. Vivian Poore and Sir William Crookes, and referring to the conservation of fixed nitrogen, and not to the profitable sale of the material. He had considered the disposal of night-soil to agriculturists as scarcely more than a side issue in his paper, but had rather expected that it would receive more attention than it had from members of local authorities who were present. The difficulty of dealing satisfactorily with night-soil increased every year. There was never any profit in the undertaking, but the loss was now greater than ever. At one time farmers would pay a fair price for night-soil decently screened; now it was frequently necessary to pay carriage to the dumping ground in order to get rid of it (by exportation) at all. As to the provision of special pails for the collection of typhoid excreta;—this provision was now made in most large conservancy centres where cases were nursed at home. It must not be forgotten, however, that cases of enteric fever were seldom reported until they had been some time in progress, and that until the disease was recognised the dejecta would ordinarily find their way into the common privy or pail.

DECISIONS OF COUNCIL ON RESOLUTIONS PASSED AT GLASGOW CONGRESS.

Recommendation made in Section I.—

"That in consideration of the insanitary condition of the mercantile marine, this Section is of opinion that the control of the sanitary arrangement of ships, both during and after construction, should be vested in Port Sanitary Authorities, and that medical inspectorships for shipping should be created on the staffs on the Local Government Boards of England, Scotland, and Ireland to supervise all suggestions from such Port Authorities for the consideration and approval of the Board, and this Section recommends the Council of the Institute to bring the proposition under the notice of the proper authorities."

The Council decided to send this resolution to the Local Government Boards of England, Scotland, and Ireland, without expressing any opinion upon it.

Recommendation made in Section I.—

"That the Council of The Sanitary Institute be recommended to make a representation to the Government of India as to the importance of publishing from time to time a report on the results of the experiments inaugurated at Port Blair, Andaman Islands, in 1902, for the prevention of malarial fevers and consumption."

The Council decided that this resolution be sent to the India Office with the approval of the Council.

Recommendation made in Conference of Veterinary Inspectors—

"That it be a recommendation from this meeting to the Council of The Sanitary Institute that the time has now come when authority should be given by the Board of Agriculture to Local Authorities for licensing stables in large towns."

The Council decided that this resolution be sent to the Local Govern- Board and to the Board of Agriculture, and suggest that this point be considered in the Amendment of the Public Health Act-.

NOTES ON LEGISLATION AND LAW CASES.

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ADULTERATION.—*Food and drugs—Institution of prosecution—Withdrawal of summons—Issue of second summons—Sale of Food and Drugs Act, 1899 (62 & 63 Vict. c. 51), s. 19, sub-s. 1.*

By s. 19, sub-s. 1, of the Sale of Food and Drugs Act, 1899, a prosecution under the Sale of Food and Drugs Act "shall not be instituted" after the expiration of twenty-eight days from the time of purchase.

An information was laid and a summons issued thereon within the twenty-eight days, but the summons not having been served within the time prescribed by s. 19, sub-s. 2, of the Act, it was allowed to drop, and, after the expiration of the twenty-eight days, a fresh summons was applied for on the same information and issued;—

Held, that there having been no adjudication on the merits of the first summons, a second summons could be issued on the information, and that it was immaterial that the second summons was issued after the expiration of the twenty-eight days, the information, which was the institution of the prosecution, having been laid within that time. Brooks *v.* Bagshaw. Div. Ct. 798.

SEWERS.—*Drain or sewer—Pipe draining several houses belonging to different owners—"Single private drain"—Local Government—Public Health Act, 1875 (38 & 39 Vict. c. 55), s. 41—Public Health Acts Amendment Act, 1890 (53 & 54 Vict. c. 59), s. 19—Nuisance—Abatement notice—Service on person not liable—Recovery of expense.*

Four houses in the defendants' district, of which the plaintiff was the owner, together with sixteen houses belonging to other owners, were drained into a pipe which at a date prior to 1890 had been connected by the defendants with a public sewer. The whole of the pipe was on private ground. A nuisance having arisen from an obstruction in the pipe near one of the plaintiff's houses, the defendants served on the plaintiff a notice under s. 94 of the Public Health Act, 1875, requiring her to abate the nuisance and relay the drain. The

plaintiff, although contending that the pipe was a sewer and repairable by the defendants, did the work under protest, and sued the defendants to recover the expense as money paid by her under compulsion which the defendants were compellable to pay:—

Held, (1) that the plaintiff had paid the money under compulsion: North *v.* Walthamstow Urban District Council (1898), 67 L. J. (Q. B.) 972 followed; (2) that although the pipe was a sewer as defined by s. 4 of the Public Health Act, 1875, it was also, on the authority of Bradford *v.* Eastbourne Corporation (1896), 2 Q. B. 205, a "single private drain" within s. 19 of the Public Health Acts Amendment Act, 1890, but that the liability to repair the pipe remained on the defendants, unless and until they put in force against the owners of the houses the procedure of s. 19 of the Act of 1890 and of s. 41 of the Act of 1875, and that, the defendants not having done so, the plaintiff was entitled to recover.

Reg. *v.* Hastings Corporation (1897), 1 Q. B. 46, followed.

Thompson *v.* Eccles Corporation (1904), 2 K. B. 1, discussed.

Haedicke *v.* Friern Barnet Urban District Council. Channell, J. 807.

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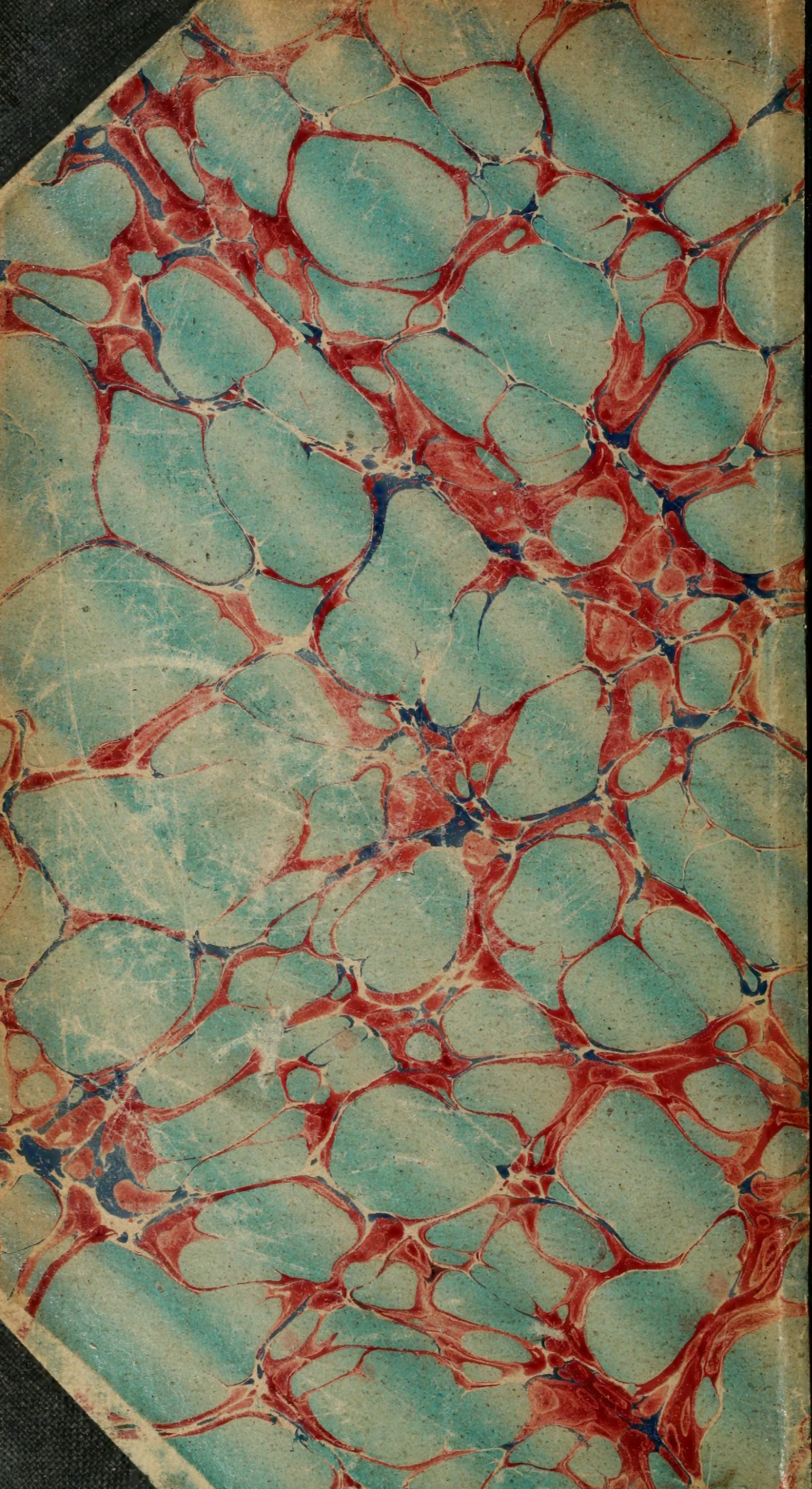
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